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ABSTRACT

This tech prep competency profile covers these occupations: manufacturing technician, computer-assisted design and drafting (CADD) technician, quality technician, and mechanical technician. Section 1 provides occupation definitions. Section 2 lists development committee members. Section 3 provides the leveling codes---abbreviations for grade level (by the end of grade 12, by the end of associate degree), academic codes (communications, math, or science related), and depth (introduce, reinforce, proficient). Section 4, the table of contents, also indicates whether the entire or partial unit is required for each of the occupations. Section 5 provides the competencies categorized into 45 units. Each unit consists of essential or local competencies divided into builders. Competencies and builders are listed in columns and followed by the codes that indicate depth and related academic area for each grade level. Unit topics are as follows: employability skills; professionalism; teamwork; professional practices; workplace safety; project management; problem analysis; general administrative functions; economic and business principles; computer literacy; quality assurance; technical recording and reporting; drafting technology; visualization and design for function; CADD fundamentals; intermediate CADD; advanced CADD; basic electricity; electronics troubleshooting and repair; programmable logic controllers; industrial electricity; electrical test and measurement equipment; equipment installation; equipment maintenance; industrial engineering basics; industrial manufacturing technology; basic materials science; mechanical power transmission; fundamentals of machine anatomy; electromechanical technology; hydraulics and pneumatics; computerized numerical control; precision machining; metal stamping dies; press technology; sheet metal fabrication; welding basics; production methods and costs; engineering mechanics; advanced engineering mechanics; computer programming; computer-based descriptive geometry; design of machines and machine elements; quality; and production planning and control. (YLB)

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COMPUTER-INTEGRATED MANUFACTURING TECHNOLOGY

TECH PREP COMPETENCY PROFILE

APRIL 1999

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COMPUTER-INTEGRATED MANUFACTURING TECHNOLOGY

TECH PREP COMPETENCY PROFILE

APRIL 1999



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**Lakeland Tech Prep Consortium
Computer-Integrated Manufacturing Technology
Tech Prep Competency Profile**

Occupation Definitions
April 1999

Manufacturing Technician

An individual who applies basic engineering principles and technical skills in support of engineers and other professionals engaged in developing and/or using manufacturing systems and processes. Technical skills should include, but not be limited to:

- machining skills
- print and schematic interpretation
- geometric dimensioning and tolerancing
- basic CADD skills
- basic electrical skills
- computerized numerical control
- programmable logic controllers
- operational diagnosis, repair, and maintenance procedures
- manufacturing methods specification and implementation
- statistical process control
- teamwork skills
- report preparation

CADD Technician

An individual who applies technical knowledge and skills to plan and prepare computerized graphical interpretations or plans and design concepts for mechanical devices and machinery. Technical skills should include, but not be limited to:

- print and schematic interpretation
- proficient drafting and CADD/CAM skills
- drawing designs from approved sketches
- drawing designs from blueprints, designs, mockups, and photoprints
- layouts, drawings, and schematics depicting function, relationship, and assembly sequence of parts and assemblies
- teamwork skills
- report preparation

Quality Technician*

An individual who applies basic engineering principles and technical skills in support of engineers and other professionals engaged in maintaining consistent manufacturing and construction standards. Technical skills should include, but not be limited to:

- quality systems management principles
- technical standards applicable to specific engineering and manufacturing projects
- testing and inspection procedures
- related instrumentation and equipment operation and maintenance
- teamwork skills
- report preparation

Mechanical Technician*

An individual who applies mathematics and physical principles to design, troubleshoot, or use mechanical, hydraulic or electromechanical devices or systems. Technical skills should include, but not be limited to:

- workplace safety
- CADD skills
- basic electrical/electronics and hydraulic principles
- physics principles and their applications
- materials used in industry and their physical properties
- product, machinery, and systems design
- teamwork skills
- report preparation
- manufacturing methods

***The programs for Quality Technician and Mechanical Technician were not reviewed in April, 1999 because they were not included in the State Competency Profile at that time. They will be reviewed at later date.**

Lakeland Tech Prep Consortium

Instructions for Use of Competency Profile Access Database

This database was created in Access 2.0. It can be loaded into later versions of Access.

The name of the file is:	electronics:	ltpc-elc.mdb
	manufacturing:	ltpc-mfg.mdb

The following reports are available using the database:

- Full Report
- High School Competencies
- High School Competencies and Builders
- Associate Degree Competencies
- Associate Degree Competencies and Builders
- High School "Introduce" Competencies and Builders
- High School "Proficient" Competencies and Builders
- Associate Degree "Introduce" Competencies and Builders
- Associate Degree "Proficient" Competencies and Builders
- Communications Related Competencies and Builders
- Mathematics Related Competencies and Builders
- Science Related Competencies and Builders

To obtain a report, open the database, click on "Reports", and double click the report you wish to see or print.

Please feel free to add fields or links to a student database in order to assist you in tracking student progress or preparing career passports. Fields could also be added to include performance objectives, lesson plans, etc.

No changes should be made to the competencies or the leveling except by the Lakeland Tech Prep Consortium office.

If you have any questions on the database, please call the Tech Prep Office at 953-7235 or Linda Fauber at (410) 747-9825.

**Lakeland Tech Prep Consortium
Computer-Integrated Manufacturing Technology
Tech Prep Competency Profile**

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April 1999

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Certified TCP Facilitator

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April 14, 1998

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Business, Industry, Labor Panel

May 1998

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Houston Machine Products, Inc., Springfield, Ohio

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May 1998**

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**Lakeland Tech Prep Consortium
Computer-Integrated Manufacturing Technology
Tech Prep Competency Profile**

LEVELING CODES

GRADE LEVEL:

12 = by the end of grade 12

AD = by the end of the Associate Degree

AC = ACADEMIC CODES:

C = Communications related

M = Math related

S = Science related

DEPTH (indicated in the 12 or AD column):

I = Introduce

R = Reinforce or add depth (after introducing or proficiency)

P = Proficient (able to perform the skill without supervision)

ESSENTIAL COMPETENCY:

The State Business, Industry and Labor Panel determined that the competency is needed to ensure **minimal** level of employability. Entry level employees should be able to perform this competency without supervision. All essential competencies must be included in local profiles for the occupation(s) and must be leveled "P" by the end of either the 12th grade or the Associate Degree.

RECOMMENDED COMPETENCY:

The local Development Committee in April 1999 determined that the competency should be included in the profile. It may have been suggested by either the State Panel or the local Development Committee. Leveling was determined by the local Development Committee.

Lakeland Tech Prep Consortium
Tech Prep Competency Profile
Computer-Integrated Manufacturing Technology
April 1999

IM	Manufacturing Technician				
CT	CADD Technician				
QT*	Quality Technician*				
MT*	Mechanical Technician*				

Pg	Unit	IM	CT	QT*	MT*
1	1. Employability Skills	X	X	X	X
9	2. Professionalism	X	X	X	X
14	3. Teamwork	X	X	X	X
17	4. Professional Practices	X	X	X	X
19	5. Workplace Safety	X	X	X	X
22	6. Project Management	X	X	X	X
23	7. Problem Analysis	X	X	X	X
24	8. General Administrative Functions	X	X	X	X
25	9. Economic and Business Principles	X	X	X	X
27	10. Computer Literacy	X	X	X	X
40	11. Quality Assurance	X	X	X	X
47	12. Technical Recording and Reporting	X	X	X	X
49	13. Drafting Technology	X	X	X	X
56	14. Visualization and Design for Function	X	X		
57	15. CADD Fundamentals	X	X	X	X
61	16. Intermediate CADD	X	X	O	O
62	17. Advanced CADD		X		
67	18. Basic Electricity	X	X	X	X
71	19. Electronics Troubleshooting and Repair for IM	X			
73	20. Programmable Logic Controllers (PLCs)	X			
76	21. Industrial Electricity	X			
83	22. Electrical Test & Measurement Equipment	X		X	X
84	23. Equipment Installation	X			
86	24. Equipment Maintenance	X			
90	25. Industrial Engineering Basics	X			
	(Continued)				

X = Entire unit required for the occupation

O = Partial unit required for the occupation

*The programs for Quality Technician and Mechanical Technician were not reviewed in April, 1999 because they were not included in the State Competency Profile at that time. They will be reviewed in detail at later date.

Pg	Unit	IM	CT	QT*	MT*
94	26. Industrial Manufacturing Technology	X		O	O
101	27. Basic Materials Science	X	X	X	X
108	28. Mechanical Power Transmission	X		O	X
118	29. Fundamentals of Machine Anatomy	X			
120	30. Electromechanical Technology for IM	X		X	X
124	31. Hydraulics and Pneumatics	X		X	X
130	32. Computerized Numerical Control (CNC)	X	O		
135	33. Precision Machining	X		X	X
145	34. Metal Stamping Dies	X			
147	35. Press Technology	X	X	X	X
148	36. Sheet Metal Fabrication	X		X	X
149	37. Welding Basics	X		X	X
152	38. Production Methods & Costs	X		X	X
154	39. Engineering Mechanics		X		X
156	40. Advanced Engineering Mechanics				X
158	41. Computer Programming	X	X	X	X
160	42. Computer-Based Descriptive Geometry		X		
161	43. Design of Machines and Machine Elements				X
163	44. Quality			X	
171	45. Production Planning and Control			X	

X = Entire unit required for the occupation

O = Partial unit required for the occupation

*The programs for Quality Technician and Mechanical Technician were not reviewed in April, 1999 because they were not included in the State Competency Profile at that time. They will be reviewed in detail at later date.

Lakeland Tech Prep Consortium

Computer-Integrated Manufacturing Technology

Competency Profile - April, 1999

<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
U 01.00.00	Employability Skills			
EC 01.01.00	Develop a career plan	P	R	CMS
B 01.01.01	Identify current interests and aptitudes	P	R	
B 01.01.02	Identify common barriers to employment	P	R	
B 01.01.03	Describe strategies to overcome employment barriers	P	R	
B 01.01.04	Locate resources for finding employment	P	R	
B 01.01.05	Research job trends	P	R	
B 01.01.06	Identify career options	P	R	
B 01.01.07	Identify advantages and disadvantages of career options (in addition to other than monetary)	P	R	
B 01.01.08	Identify job requirements	P	R	
B 01.01.09	Investigate education/training opportunities	P	R	
B 01.01.10	Evaluate personal strengths and weaknesses	P	R	

U = Unit Name

EC = Essential Competency (determined by State Panel)

RC = Local Competency (may have been recommended by State Panel or Local Panel)

B = Builder

I = Introduce

P = Proficient (able to perform without supervision)

R = Reinforce (add depth)

C, M, S = Communications, Math or Science related

<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 01.02.00	Prepare for employment	P	R	CMS
B 01.02.01	Identify traditional and non-traditional employment sources	P	R	
B 01.02.02	Identify present and future employment opportunities (by geographic location)	P	R	
B 01.02.03	Research job opportunities, including non-traditional careers	P	R	
B 01.02.04	Compare salary ranges and benefit packages	P	R	
B 01.02.05	Compile occupational profile	P	R	
B 01.02.06	Identify rights and responsibilities of equal employment opportunity laws	P	R	
B 01.02.07	Design resume and cover letter	P	R	
B 01.02.08	Secure references	P	R	
B 01.02.09	Investigate generic and specific employment tests (e.g., civil service exam; drug screening)	P	R	
B 01.02.10	Use follow-up techniques to enhance employment potential	P	R	
B 01.02.11	Demonstrate legible written communication skills using correct grammar, spelling, punctuation, and concise wording	P	R	
B 01.02.12	Describe methods for handling illegal questions on job application forms and during interviews	P	R	
B 01.02.13	Write letter of application	P	R	
B 01.02.14	Research prospective employer and services performed	P	R	
B 01.02.15	Explain critical importance of personal appearance, hygiene, and demeanor	P	R	
B 01.02.16	Interpret job description	P	R	
B 01.02.17	Demonstrate appropriate interview question and answer techniques	P	R	
B 01.02.18	Demonstrate methods for handling difficult interview questions	P	R	
B 01.02.19	Evaluate job offers	P	R	

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RC = Local Competency (may have been recommended by State Panel or Local Panel)

B = Builder

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
B 01.02.20	Write letter of acceptance	P	R	
B 01.02.21	Write letter of declination	P	R	
B 01.02.22	Demonstrate good listening skills	P	R	
B 01.02.23	Ask for the job tactfully	P	R	
B 01.02.24	Participate in extracurricular activities (e.g., student government, community projects)	P	R	
EC 01.03.00	Evaluate the importance of self-esteem as an employability skill	P	R	C
B 01.03.01	Identify factors that affect self-esteem	P	R	
B 01.03.02	Compare effects of low self-esteem and high self-esteem	P	R	
B 01.03.03	Identify strategies to promote positive self-esteem	P	R	

U = Unit Name
 EC = Essential Competency (determined by State Panel)
 RC = Local Competency (may have been recommended by State Panel or Local Panel)
 B = Builder

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 R = Reinforce (add depth)
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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 01.04.00	Demonstrate job retention skills	P	R	C
B 01.04.01	Identify employer expectations regarding job performance, work habits, attitudes, personal appearance, and hygiene	P	R	
B 01.04.02	Exhibit appropriate work habits and attitude	P	R	
B 01.04.03	Demonstrate ability to set priorities	P	R	
B 01.04.04	Identify behaviors to establish successful working relationships	P	R	
B 01.04.05	Identify alternatives for dealing with harassment, bias, and discrimination based on race, color, national origin, sex, religion, handicap, or age	P	R	
B 01.04.06	Identify opportunities for advancement	P	R	
B 01.04.07	List reasons for termination	P	R	
B 01.04.08	List consequences of being absent frequently from job	P	R	
B 01.04.09	List consequences of frequently arriving late for work	P	R	
B 01.04.10	Demonstrate interpersonal relations skills (i.e., verbal and written)	P	R	
B 01.04.11	Demonstrate negotiation skills	P	R	
B 01.04.12	Demonstrate teamwork	P	R	
B 01.04.13	Follow chain-of-command	P	R	
B 01.04.14	Exhibit appropriate job dedication	P	R	

U = Unit Name
 EC = Essential Competency (determined by State Panel)
 RC = Local Competency (may have been recommended by State Panel or Local Panel)
 B = Builder

22

I = Introduce
 P = Proficient (able to perform without supervision)
 R = Reinforce (add depth)
 C, M, S = Communications, Math or Science related

<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 01.05.00	Demonstrate knowledge of work ethic	P	R	C
B 01.05.01	Define work ethic	P	R	
B 01.05.02	Identify factors that influence work ethic	P	R	
B 01.05.03	Differentiate between law and ethics	P	R	
B 01.05.04	Describe how personal values are reflected in work ethic	P	R	
B 01.05.05	Describe how interactions in the workplace affect personal work ethic	P	R	
B 01.05.06	Describe how life changes affect personal work ethic	P	R	

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 EC = Essential Competency (determined by State Panel)
 RC = Local Competency (may have been recommended by State Panel or Local Panel)
 B = Builder

I = Introduce
 P = Proficient (able to perform without supervision)
 R = Reinforce (add depth)
 C, M, S = Communications, Math or Science related

<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 01.06.00	Exhibit appropriate work ethic	P	R	C
B 01.06.01	Use time-management techniques	P	R	
B 01.06.02	Avoid personal activity during work hours	P	R	
B 01.06.03	Attend work as scheduled	P	R	
B 01.06.04	Adhere to company and/or governmental policies, procedures, rules, and regulations	P	R	
B 01.06.05	Exercise confidentiality	P	R	
B 01.06.06	Demonstrate appropriate human relations skills	P	R	
B 01.06.07	Adhere to rules of conduct	P	R	
B 01.06.08	Accept constructive criticism	P	R	
B 01.06.09	Offer constructive criticism	P	R	
B 01.06.10	Take pride in work	P	R	
B 01.06.11	Resolve conflict	P	R	
B 01.06.12	Manage stress	P	R	
B 01.06.13	Avoid sexual connotations and harassment	P	R	
B 01.06.14	Adjust to changes in the workplace	P	R	
B 01.06.15	Demonstrate punctuality	P	R	
B 01.06.16	Assume responsibility for personal decisions and actions	P	R	
B 01.06.17	Take responsibility for assignments	P	R	
B 01.06.18	Follow chain-of-command	P	R	

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EC 01.07.00	Apply decision-making techniques	P	R	CMS
B 01.07.01	Identify decision to be made	P	R	
B 01.07.02	Identify ownership of decision to be made	P	R	
B 01.07.03	Identify possible alternatives and their consequences	P	R	
B 01.07.04	Make decisions based on facts, legality, ethics, goals, and/or corporate culture	P	R	
B 01.07.05	Apply time factor(s)	P	R	
B 01.07.06	Present decision to be implemented	P	R	
B 01.07.07	Evaluate decision made	P	R	
B 01.07.08	Take responsibility for decision	P	R	
EC 01.08.00	Apply problem-solving techniques	P	R	CMS
B 01.08.01	Identify problem	P	R	
B 01.08.02	Select appropriate problem solving tools/techniques	P	R	
B 01.08.03	Identify root problem cause(s)	P	R	
B 01.08.04	Track root problem cause(s)	P	R	
B 01.08.05	Identify possible solutions and their consequences (e.g., long term, short term, crisis)	P	R	
B 01.08.06	Use resources to explore possible solutions to problem	P	R	
B 01.08.07	Contrast advantages and disadvantages of each solution	P	R	
B 01.08.08	Identify appropriate action	P	R	
B 01.08.09	Evaluate results	P	R	
B 01.08.10	Identify post-preventive action	P	R	

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EC 01.09.00	Exhibit characteristics for job advancement	P	R	C
B 01.09.01	Display positive attitude	P	R	
B 01.09.02	Demonstrate knowledge of position	P	R	
B 01.09.03	Perform quality work	P	R	
B 01.09.04	Adapt to changing situations and technology	P	R	
B 01.09.05	Demonstrate capability/responsibility for different positions	P	R	
B 01.09.06	Identify characteristics of effective leaders	P	R	
B 01.09.07	Identify opportunities for leadership in work place/community	P	R	
B 01.09.08	Demonstrate initiative to affect change in workplace	P	R	
B 01.09.09	Participate in continuing education/training program	P	R	
B 01.09.10	Respond appropriately to criticism from employer, supervisor, or other employees	P	R	
B 01.09.11	Exhibit awareness of corporate culture	P	R	
B 01.09.12	Prepare for job setbacks	P	R	
B 01.09.13	Exhibit continual growth based on performance evaluation	P	R	
B 01.09.14	Set realistic goals	P	R	

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26

8

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U 02.00.00 Professionalism

EC 02.01.00	Project professional image	P	R	CMS
B 02.01.01	Define professionalism	P	R	
B 02.01.02	Exhibit professional appearance	P	R	
B 02.01.03	Exhibit professional manners	P	R	
B 02.01.04	Project professional attitude	P	R	
B 02.01.05	Identify individuals' vital role in organization	P	R	
B 02.01.06	Exhibit proper etiquette in professionally-related situations	P	R	
EC 02.02.00	Formulate individual and professional goals	P	R	CMS
B 02.02.01	Set flexible, realistic, and measurable goals	P	R	
B 02.02.02	Identify potential barriers to achieving goals	P	R	
B 02.02.03	Identify strategies for addressing barriers to goal achievement	P	R	
B 02.02.04	Breakdown long-term goals into short-term goals	P	R	
B 02.02.05	Prioritize goals	P	R	
B 02.02.06	Commit to goals	P	R	
B 02.02.07	Adjust goals	P	R	
B 02.02.08	Obtain support for goals	P	R	
B 02.02.09	Reward goals achievement	P	R	

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RC 02.03.00	Manage personal finances	I		CM
B 02.03.01	Explain need for personal management records	I		
B 02.03.02	Balance checkbook	I		
B 02.03.03	Identify tax obligations	I		
B 02.03.04	Analyze how credit affects financial security	I		
B 02.03.05	Compare types and methods of investment	I		
B 02.03.06	Compare types and methods of borrowing	I		
B 02.03.07	Compare types and methods of insurance	I		
B 02.03.08	Compare types of retirement options/plans	I		
B 02.03.09	Identify discretionary vs. non-discretionary expenditures	I		
EC 02.04.00	Support community well-being	P		CMS
B 02.04.01	Identify environmental, educational, and social issues	P		
B 02.04.02	Participate in social and/or community activities	P		
EC 02.05.00	Contribute to organizational goals	I	P	CMS
B 02.05.01	Evaluate personal goals in relation to organizational goals	I	P	
B 02.05.02	Monitor progress by evaluating feedback	I	P	
B 02.05.03	List responsibilities in relation to organizational goals	I	P	
B 02.05.04	Accomplish assigned tasks	I	P	
B 02.05.05	Exercise responsibility in relation to organizational goals	I	P	
B 02.05.06	Set appropriate personal performance standards	I	P	
B 02.05.07	Communicate goals with supervisor and peers	I	P	
B 02.05.08	Demonstrate knowledge of products and services	I	P	
B 02.05.09	Promote organizational image and mission	I	P	

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EC 02.06.00	Demonstrate positive relations in the workplace	I	P	CMS
B 02.06.01	Identify personality types of self and others	I	P	
B 02.06.02	Identify various management styles	I	P	
B 02.06.03	Support employer expectations	I	P	
B 02.06.04	Support employer decisions	I	P	
B 02.06.05	Accept constructive criticism	I	P	
B 02.06.06	Give constructive feedback	I	P	
B 02.06.07	Adapt to changes in work place	I	P	
B 02.06.08	List factors to consider before resigning	I	P	
B 02.06.09	Write letter of resignation	I	P	
RC 02.07.00	Manage stressful situations	I	R	C
B 02.07.01	Accept stress as part of daily life	I	R	
B 02.07.02	Identify personal and professional factors contributing to stress	I		
B 02.07.03	Describe physical and emotional responses to stress	I		
B 02.07.04	Evaluate positive and negative effects of stress on productivity	I		
B 02.07.05	Identify strategies for reducing stress	I		
B 02.07.06	Implement strategies to manage stress	I		
B 02.07.07	Create strategies for developing and maintaining support systems	I		

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EC 02.08.00	Analyze effects of family on work and work on family	I	P	CMS
B 02.08.01	Identify how family values, goals, and priorities are reflected in work place	I	P	
B 02.08.02	Identify responsibilities and rewards associated with paid and non-paid work	I	P	
B 02.08.03	Identify responsibilities and rewards associated with families	I	P	
B 02.08.04	Explain how family responsibilities can conflict with work	I	P	
B 02.08.05	Explain how work can conflict with family responsibilities	I	P	
B 02.08.06	Explain how work-related stress can affect families	I	P	
B 02.08.07	Explain how family-related stress can affect work	I	P	
B 02.08.08	Identify family support systems and resources	I	P	
B 02.08.09	Identify work-related support systems and resources	I	P	
B 02.08.10	Communicate with family regarding work	I	P	
EC 02.09.00	Apply lifelong learning skills	I	P	C
B 02.09.01	Define lifelong learning	I	P	
B 02.09.02	Identify factors that cause need for lifelong learning	I	P	
B 02.09.03	Analyze effects of change	I	P	
B 02.09.04	Identify reasons why goals change	I	P	
B 02.09.05	Describe importance of flexibility and adaptability	I	P	
B 02.09.06	Evaluate need for continuing education/training	I	P	

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30

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EC 02.10.00	Manage professional development	I	P	C
B 02.10.01	Identify career opportunities	I	P	
B 02.10.02	Modify career plan	I	P	
B 02.10.03	Participate in continuing education/training opportunities	I	P	
B 02.10.04	Document continuing education/training	I	P	
B 02.10.05	Read profession-related manuals, technical journals, and periodicals	I	P	
B 02.10.06	Participate in professional organizations	I	P	
B 02.10.07	Build personal/professional mentor relationship	I	P	
B 02.10.08	Build personal/professional support system	I	P	
B 02.10.09	Build professional network	I	P	
B 02.10.10	Strengthen communication skills	I	P	
B 02.10.11	Strengthen leadership skills	I	P	
B 02.10.12	Strengthen management skills	I	P	

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U 03.00.00	Teamwork			
EC 03.01.00	Demonstrate knowledge of teamwork	P		C
B 03.01.01	Define employee empowerment	P		
B 03.01.02	Differentiate work groups and teams	P		
B 03.01.03	Identify conditions essential to teamwork (e.g., brainstorming)	P		
B 03.01.04	Explain influence of culture (e.g., corporate, community) on teamwork	P		
B 03.01.05	Identify appropriate situations for using teams	P		
B 03.01.06	Define team structures (e.g., cross functional, quality improvement, task force, quality circles)	P		
B 03.01.07	Identify team building concepts	P		
B 03.01.08	Describe characteristics and dynamics of teams	P		
B 03.01.09	Identify characteristics of effective team leaders and members	P		
B 03.01.10	Identify responsibilities of valuable team members	P		
B 03.01.11	Identify methods of involving each member of a team	P		
B 03.01.12	Explain how individuals from various backgrounds contribute to work-related situations (e.g., technical training, cultural heritage)	P		
B 03.01.13	Explain the purpose of facilitators	P		
B 03.01.14	Define consensus	P		
B 03.01.15	Define reward/recognition system	P		

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32

14

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EC 03.02.00	Demonstrate teamwork	P		C
B 03.02.01	Identify purpose of team and intended goal (include time frames)	P		
B 03.02.02	Structure team around purpose	P		
B 03.02.03	Define responsibilities of team members	P		
B 03.02.04	Contribute to efficiency and success of team	P		
B 03.02.05	Work toward individual and team milestones	P		
B 03.02.06	Analyze results of team project	P		
B 03.02.07	Facilitate a team meeting	P		
B 03.02.08	Assist team member(s) with problem	P		
B 03.02.09	Monitor time frame	P		
B 03.02.10	Stress continuous improvement	P		
B 03.02.11	Accept failure as part of learning	P		
EC 03.03.00	Use teamwork to solve problems	I	P	CMS
B 03.03.01	Identify appropriate situations for using teams	P		
B 03.03.02	Use problem-solving process in a team setting	P		
B 03.03.03	Identify quality management processes/techniques	I	P	
B 03.03.04	Identify quality assurance processes/techniques	I	P	
B 03.03.05	Prepare presentation	P		

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EC 03.04.00	Conduct team meetings	I	P	C
B 03.04.01	Plan agenda	I	P	
B 03.04.02	Schedule meeting and location	I	P	
B 03.04.03	Invite appropriate personnel	I	P	
B 03.04.04	Solicit outside speakers as needed	I	P	
B 03.04.05	Assign someone to take minutes	I	P	
B 03.04.06	Facilitate introductions	I	P	
B 03.04.07	Invite questions and comments and group participation	I	P	
B 03.04.08	Focus team on agenda items	I	P	
B 03.04.09	Assign appropriate action, time frame and accountability to tasks	I	P	
B 03.04.10	Monitor time	I	P	
B 03.04.11	Close meeting on time	I	P	
B 03.04.12	Publish minutes in timely manner	I	P	
B 03.04.13	Set ground rules	I	P	
B 03.04.14	Avoid placing individual agendas above the group's agenda	I	P	

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U 04.00.00	Professional Practices			
EC 04.01.00	Explain professional responsibilities	P	R	CMS
B 04.01.01	Explain the need for professional and ethical standards	P	R	
B 04.01.02	Explain responsibility of the individual to apply ethical standards	P	R	
B 04.01.03	Identify responsibility to client(s) and employer(s)	P	R	
B 04.01.04	Explain consequences of unprofessional and/or unethical behavior	P	R	
B 04.01.05	Explain importance of conflict resolution in the workplace	P	R	
EC 04.02.00	Identify legal and ethical behavior	I	P	CMS
B 04.02.01	Differentiate between legal and ethical behavior	I	P	
B 04.02.02	Explain terms, principles, and characteristics of legal and ethical behavior (e.g., loyalty, discretion, solicitation, competitor, supplier)		P	
B 04.02.03	Explain legal ramifications of breaching rules and regulations		P	
B 04.02.04	Explain effects of unethical and/or unlawful behavior	I	P	
B 04.02.05	Practice within scope of the profession		P	

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EC 04.03.00	Function as a self-managed employee	I	P	CM
B 04.03.01	Propose project		P	C
B 04.03.02	Organize tasks	I	P	
B 04.03.03	Manage time	I	P	
B 04.03.04	Meet deadlines	I	P	
B 04.03.05	Maintain business records		P	C
B 04.03.06	Make long-term and short-term plans		P	
B 04.03.07	Evaluate progress	I	P	
B 04.03.08	Report progress	I	P	C
B 04.03.09	Delegate project	I	P	
EC 04.04.00	Follow intellectual property rights and copyright laws	I	P	C
B 04.04.01	Explain purpose of patent	I	P	
B 04.04.02	Explain purpose of copyright	I	P	
B 04.04.03	Explain purpose of licenses	I	P	
B 04.04.04	Explain purpose of trademarks and registered names		P	
B 04.04.05	Explain rights of the originator		P	
B 04.04.06	Explain rights of the public		P	
B 04.04.07	Define confidentiality		P	
B 04.04.08	Define proprietary		P	
B 04.04.09	Explain legal ownership of proprietary material	I	P	
B 04.04.10	Describe stock image/text usage rights		P	
B 04.04.11	Explain negotiation of contracts		P	
B 04.04.12	Explain reproduction licensing and residual usage		P	

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U 05.00.00 Workplace Safety

RC 05.01.00	Demonstrate knowledge of safety and workplace hazards	P	R
B 05.01.01	Describe corrective procedures for unsafe conditions	P	R
B 05.01.02	Identify types and potential level of workplace hazards (e.g., physical hazards, fire, chemicals, noise, ionizing radiation, ultraviolet, temperature extremes, ergonomics, biological hazards)	P	R
B 05.01.03	Identify safety materials/equipment (e.g., absorbent socks, oil dry)	P	R
B 05.01.04	Identify purpose of emergency evacuation routes, master switch and lockout locations, and safety color coding systems	P	R
B 05.01.05	Describe methods of evaluating potential hazards (e.g., visual analysis)	P	R
B 05.01.06	Describe methods of correcting potential hazards	P	R
B 05.01.07	Identify need for reporting accidents	P	R
B 05.01.08	Explain precautions required when using toxic or flammable materials	P	R
B 05.01.09	Define confined space and related requirements	P	R

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37

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EC 05.02.00	Maintain safe working environment	P	R	CMS
B 05.02.01	Comply with company's safety procedures regarding safe handling of hazardous materials	P	R	
B 05.02.02	Locate MSDS	P	R	
B 05.02.03	Maintain clean work area by removing waste, keeping alleyways clear, cleaning tools, and preventing spills	P	R	
B 05.02.04	Minimize workplace causes of environmental burdening, pollutants, and poisoning	P	R	
B 05.02.05	Describe pollution solution limits imposed by permits and regulations	P	R	
B 05.02.06	Identify visual equipment controls (e.g., monitors, read outs)	P	R	
B 05.02.07	Identify auditory equipment controls	P	R	
B 05.02.08	Identify personal protective wear and equipment	P	R	
B 05.02.09	Use personal protective wear and equipment	P	R	
B 05.02.10	Comply with workplace safety rules and procedures	P	R	
B 05.02.11	Comply with personal safety rules and procedures	P	R	
B 05.02.12	Comply with applicable electrical, mechanical, hydraulic and pneumatic safety rules and procedures	P	R	
B 05.02.13	Recycle appropriate materials	P	R	
B 05.02.14	Use preventive maintenance checklists	P	R	
B 05.02.15	Identify location of control panels, shut-off valves, and fire extinguishers	P	R	
B 05.02.16	Perform lockout and tagout	P	R	
B 05.02.17	Explain basic philosophy of "right to know" legislation	P	R	

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RC 05.03.00	Demonstrate knowledge of occupational ergonomics	I	I	CMS
B 05.03.01	Define ergonomics	I	R	
B 05.03.02	Define risk factor	I	R	
B 05.03.03	Define maximum permissible limit (MPL) and action limit (AL) for lifting		I	
B 05.03.04	Define cumulative trauma disorder (CTD)		I	
B 05.03.05	Identify susceptibility factors for CTD		I	

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U 06.00.00	Project Management			
EC 06.01.00	Explain project management	I	P	C
B 06.01.01	Identify project purpose/goal	I	P	
B 06.01.02	Identify project objectives	I	P	
B 06.01.03	Identify work breakdown structure (WBS)		P	
B 06.01.04	Identify resource requirements		P	
B 06.01.05	Identify project economics/funding		P	
B 06.01.06	Identify risks		P	
EC 06.02.00	Implement projects	I	P	CMS
B 06.02.01	Plan project	I	P	
B 06.02.02	Monitor project		P	
B 06.02.03	Modify project		P	
EC 06.03.00	Evaluate projects	I	P	CMS
B 06.03.01	Analyze performance		P	
B 06.03.02	Perform critical review of project	I	P	
B 06.03.03	Draw project conclusions		P	
B 06.03.04	Contribute to written summary		P	

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U 07.00.00	Problem Analysis			
EC 07.01.00	Appraise situations	P	R	CMS
B 07.01.01	Identify concerns	P	R	
B 07.01.02	Identify objectives	P	R	
B 07.01.03	Set priorities	P	R	
B 07.01.04	Identify resolution process	P	R	
B 07.01.05	Plan resolution	P	R	
RC 07.02.00	Analyze problems	I	P	CMS
B 07.02.01	Identify potential problems	I	P	
B 07.02.02	Identify likely causes	I	P	
B 07.02.03	Test for probable causes		P	
B 07.02.04	Verify cause		P	
B 07.02.05	Identify preventive actions		P	
B 07.02.06	Identify contingent actions		P	
RC 07.03.00	Analyze decisions	I	P	CMS
B 07.03.01	Identify objective(s)	I	P	
B 07.03.02	Identify alternatives	I	P	
B 07.03.03	Evaluate alternatives	I	P	
B 07.03.04	Assess risks		P	
B 07.03.05	Make final choice	I	P	
B 07.03.06	Determine effectiveness of decision		P	
B 07.03.07	Document results		P	

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U 08.00.00	General Administrative Functions			
EC 08.02.00	Manage records	I	P	C
B 08.02.01	Implement filing system	I	P	
B 08.02.02	Implement retention system		P	
B 08.02.03	Perform electronic filing operations		P	
B 08.02.04	Maintain inventory records	I	P	
B 08.02.05	Retrieve files		P	

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42

24

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U 09.00.00	Economic and Business Principles			
RC 09.01.00	Describe basic economic concepts	I	I	CM
B 09.01.01	Explain concept of economic resources		I	
B 09.01.02	Explain importance of economic resources		I	
B 09.01.03	Explain concept of economic goods and services		I	
B 09.01.04	Differentiate between economic goods and services		I	
B 09.01.05	Differentiate between needs and wants	I	R	
B 09.01.06	Explain concept of supply and demand		I	
B 09.01.07	Explain concept of price	I	R	
B 09.01.08	Explain how supply, demand, and price are related		I	
B 09.01.09	Explain concept of private enterprise and business ownership		I	
B 09.01.10	Explain concept of profit	I	R	
B 09.01.11	Explain concept of risk		I	
B 09.01.12	Explain concept of competition		I	
B 09.01.13	Explain relationship among risk, competition, and profit		I	
B 09.01.14	Describe global economic and world markets		I	
B 09.01.15	Describe economic cycles (e.g., unemployment, recession, inflation, budget deficits)		I	
B 09.01.16	Describe economic arena's effect on business (e.g., financial, competitor indicators, industry)		I	
B 09.01.17	Describe relationship between government and business		I	
B 09.01.18	Describe relationship between labor and management		I	
B 09.01.19	Compare types of economic systems		I	

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43

25

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
RC 09.02.00	Understand income statement data	I	I	M
B 09.02.01	Identify revenue	I	R	
B 09.02.02	Identify overhead expenses	I	R	
B 09.02.03	Identify fixed expenses		I	
B 09.02.04	Identify direct labor		I	
B 09.02.05	Identify indirect labor		I	
B 09.02.06	Identify direct and indirect materials		I	
B 09.02.07	Identify general and administrative expenses		I	
B 09.02.08	Identify selling expenses		I	
B 09.02.09	Identify net income		I	
B 09.02.10	Explain the difference between cash flow and profit	I	R	
B 09.02.11	Explain the difference between cash flow and cash balance	I	R	
EC 09.03.00	Explain legal concepts	I	P	C
B 09.03.01	Define legal terminology		P	
B 09.03.02	Explain business law concepts		P	
B 09.03.03	Identify contracts and/or legal documents	I	P	
B 09.03.04	Explain relationship of laws and regulations to company contracts, policies, and procedures	I	P	
B 09.03.05	Identify laws relating to working conditions, wages and hours, civil rights, social security, disability, unemployment insurance, and exempt vs. nonexempt		P	
B 09.03.06	Explain collective bargaining agreement		P	

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44

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U 10.00.00 Basic Computer Concepts and Applications

EC 10.01.00	Describe personal computer operations	P	R	CS
B 10.01.01	Explain how data is stored in main computer memory	P	R	
B 10.01.02	Explain how computer system executes program instruction	P	R	
B 10.01.03	Explain computer storage capacity	P	R	
B 10.01.04	Explain how data is represented	P	R	
B 10.01.05	Describe data storage techniques	P	R	
B 10.01.06	Identify types of memory	P	R	
 EC 10.02.00	 Demonstrate basic computer literacy	 P	 R	 C
B 10.02.01	Create ASCII text files with a text editor	P	R	
B 10.02.02	Explain rules for naming files and directories	P	R	
B 10.02.03	Manage files	P	R	
B 10.02.04	Create directories/folders and sub-directories	P	R	
B 10.02.05	Manipulate directories	P	R	
B 10.02.06	Manipulate files (copy, rename, move, delete)	P	R	
B 10.02.07	Format disks	P	R	
B 10.02.08	Label diskettes	P	R	
B 10.02.09	Explain the syntax of operating system commands	P	R	
B 10.02.10	Use wildcards in operating system commands	P	R	
B 10.02.11	Keyboard proficiently by touch	P	R	

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EC 10.03.00	Explain information processing cycle	P	R	C
B 10.03.01	Differentiate operating systems (e.g., DOS, Windows, UNIX, MAC)	P	R	
B 10.03.02	Describe computer languages and their use	P	R	
B 10.03.03	Describe difference between data files and program files	P	R	
B 10.03.04	Identify PC hardware	P	R	
B 10.03.05	Explain Internet	P	R	
B 10.03.06	Explain PC network layout	P	R	
B 10.03.07	Explain mini/mainframe network layout	P	R	
B 10.03.08	Differentiate among hardware, software, and firmware	P	R	
B 10.03.09	Differentiate open from proprietary architecture	P	R	
EC 10.04.00	Operate computer hardware	P	R	C
B 10.04.01	Practice proper media handling techniques (e.g., magnetic fields, dust, liquids)	P	R	
B 10.04.02	Identify hardware and its use	P	R	
B 10.04.03	Use hardware (e.g. mouse, diskettes, drive, modems, touch screen, printers, digitizers, scanners, cables, protection devices, plotters, graphic tablets, film recorders, video, laser image setters)	P	R	
B 10.04.04	Demonstrate basic care of hardware	P	R	
B 10.04.05	Explain need for and application of security levels/procedures	P	R	
B 10.04.06	Perform basic hardware troubleshooting	P	R	
B 10.04.07	Explain hardware addressing techniques	P	R	
B 10.04.08	Maintain usage and maintenance logs	P	R	

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46

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
EC 10.05.00	Explain operation of peripheral devices	P	R	C
B 10.05.01	Identify peripherals and operating requirements of each	P	R	
B 10.05.02	Identify primary devices used for personal computer auxiliary storage	P	R	
B 10.05.03	Describe how data is stored on diskettes and hard drives	P	R	
B 10.05.04	List speed and storage capacities of computer auxiliary storage devices	P	R	
B 10.05.05	Describe attributes of diskettes and hard disks regarding speed and storage capacity	P	R	
B 10.05.06	List types of disk storage used with large computer systems	P	R	
B 10.05.07	Define role of tape storage in relation to personal and large computers	P	R	
B 10.05.08	Describe security issues related to peripheral devices	P	R	
B 10.05.09	Explain purpose of input devices (e.g., keyboard, mouse, scanners, pens, bar code readers, credit/debit/smart cards, voice, video, gloves)	P	R	
B 10.05.10	Describe operation of output devices (e.g., voice, speaker output devices, printers, plotters, printer sharing units, SCSI interface, video display)	P	R	
B 10.05.11	Describe operation of multimedia (e.g., video, audiosound)	P	R	
B 10.05.12	Describe operation of storage devices (e.g., tape, disk, CD-ROM)	P	R	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 10.06.00	Operate peripheral devices	P	R	
B 10.06.01	Use appropriate reference materials	P	R	
B 10.06.02	Load media devices	P	R	
B 10.06.03	Start media devices	P	R	
B 10.06.04	Unload media devices	P	R	
B 10.06.05	Import, edit, and export video and audio	P	R	
B 10.06.06	Set up print devices	P	R	
B 10.06.07	Operate scanner devices	P	R	
B 10.06.08	Operate print devices	P	R	
B 10.06.09	Maintain print devices	P	R	
B 10.06.10	Monitor peripheral equipment operations	P	R	
B 10.06.11	Perform routine maintenance on peripheral devices	P	R	
B 10.06.12	List appropriate control procedures	P	R	
B 10.06.13	Transmit via modem	P	R	
B 10.06.14	Receive via modem	P	R	
B 10.06.15	Search a CD-ROM library	P	R	
B 10.06.16	Print information from a CD-ROM library	P	R	
B 10.06.17	Describe device driver	P	R	
EC 10.07.00	Store media	I	P	
B 10.07.01	Identify need for data library		P	
B 10.07.02	Retrieve stored media (e.g., on-line, off-line, permanent, off-site)	I	P	
B 10.07.03	File stored media (e.g., on-line, off-line, permanent, off-site)	I	P	
B 10.07.04	Initialize media		P	
B 10.07.05	Catalog media		P	

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EC 10.08.00	Explain software applications	P	R	C
B 10.08.01	Define software types and functions	P	R	
B 10.08.02	Describe need for application software	P	R	
B 10.08.03	Describe different types of software applications	P	R	
B 10.08.04	Explain advantages and disadvantages of integrated and dedicated software	P	R	
B 10.08.05	Differentiate features between like applications	P	R	
B 10.08.06	List software sources	P	R	
B 10.08.07	Explain software copyright laws	P	R	
B 10.08.08	Explain data compression techniques	P	R	
B 10.08.09	Explain use of passwords/security	P	R	
B 10.08.10	Explain desktop productivity tools	P	R	

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EC 10.09.00	Use word processing packages	P	R	C
B 10.09.01	Define word processing terminology	P	R	
B 10.09.02	Explain functions of word processing software	P	R	
B 10.09.03	Explain word processing applications	P	R	
B 10.09.04	Use appropriate reference materials including on-line help	P	R	
B 10.09.05	Keyboard efficiently by touch	P	R	
B 10.09.06	Use mouse	P	R	
B 10.09.07	Initialize diskette	P	R	
B 10.09.08	Prepare backup file	P	R	
B 10.09.09	Maintain backup file	P	R	
B 10.09.10	Update spelling dictionary and spell check	P	R	
B 10.09.11	Perform document functions (e.g., locate, rename, delete, save, retrieve, copy)	P	R	
B 10.09.12	Perform formatting functions (e.g., center, underline, bold, cut and paste)	P	R	
B 10.09.13	Use edit features	P	R	
B 10.09.14	Use sort features	P	R	
B 10.09.15	Add page numbers to document	P	R	
B 10.09.16	Add headers and footers	P	R	
B 10.09.17	Print files, pages, screens and blocks of text	P	R	
B 10.09.18	Verify accuracy of output	P	R	
B 10.09.19	Create a document	P	R	
B 10.09.20	Save a document to disk	P	R	
B 10.09.21	Retrieve a document from disk	P	R	
B 10.09.22	Edit an existing document	P	R	
B 10.09.23	Describe word-wrap	P	R	

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B 10.09.24	Print a document	P	R	
B 10.09.25	Store boilerplate material (e.g., templates, stationary files)	P	R	
B 10.09.26	Compose documents at keyboard	P	R	
B 10.09.27	Create multiple columns	P	R	
B 10.09.28	Prepare new documents from existing ones	P	R	
B 10.09.29	Merge selected copy with new information	P	R	
B 10.09.30	Prepare various types of tables	P	R	
B 10.09.31	Format text	P	R	
B 10.09.32	Integrate database, spreadsheet and graphic files	P	R	
B 10.09.33	Convert documents from one system/version to another	P	R	
B 10.09.34	Demonstrate use of computer thesaurus	P	R	
B 10.09.35	Use multimedia techniques/resources	P	R	
B 10.09.36	Perform merge functions	P	R	

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EC 10.10.00	Use spreadsheet packages	P	R	S
B 10.10.01	Define spreadsheet	P	R	
B 10.10.02	Explain basic spreadsheet terminology	P	R	
B 10.10.03	Define components of spreadsheets	P	R	
B 10.10.04	Describe implementation of spreadsheet operations in business scope	P	R	
B 10.10.05	Use mouse	P	R	
B 10.10.06	Use spell check	P	R	
B 10.10.07	Execute an electronic spreadsheet	P	R	
B 10.10.08	Enter data, formulas, and functions	P	R	
B 10.10.09	Differentiate between labels and numbers	P	R	
B 10.10.10	Speculate using "what if..." questions	P	R	
B 10.10.11	Sequence keystrokes in the creation of a macro	P	R	
B 10.10.12	Create database within spreadsheet	P	R	
B 10.10.13	Perform data query functions	P	R	
B 10.10.14	Move around in spreadsheet and correct errors	P	R	
B 10.10.15	Create links to other files	P	R	
B 10.10.16	Format spreadsheet	P	R	
B 10.10.17	Create graphs	P	R	
B 10.10.18	Print graphs	P	R	
B 10.10.19	Save previously saved files	P	R	
B 10.10.20	Load previously saved files	P	R	
B 10.10.21	Replicate cells using copy commands	P	R	
B 10.10.22	Use electronic spreadsheet to complete business application	P	R	
B 10.10.23	Use spreadsheet to plan financial strategies	P	R	
B 10.10.24	Prepare spreadsheet	P	R	

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B 10.10.25	Use multimedia techniques/resources	P	R	
EC 10.11.00	Use databases	P	R	CM
B 10.11.01	Define database	P	R	
B 10.11.02	Explain terms used in database systems	P	R	
B 10.11.03	Describe common functions of database systems	P	R	
B 10.11.04	Use database to design, create, input, edit, and display fields and records	P	R	
B 10.11.05	Analyze structure of database files	P	R	
B 10.11.06	Perform calculations with a database file	P	R	
B 10.11.07	Alter structure of database file	P	R	
B 10.11.08	Sort records based on multiple fields	P	R	
B 10.11.09	Identify advanced database technology	P	R	
B 10.11.10	Use appropriate reference materials	P	R	
B 10.11.11	Utilize relational database	P	R	
B 10.11.12	Enter elements into database	P	R	
B 10.11.13	Proofread database	P	R	
B 10.11.14	Explain database	P	R	
B 10.11.15	Design report formats	P	R	
B 10.11.16	Import/export data from alternate file formats	P	R	
B 10.11.17	Transfer data to and from remote database	P	R	
B 10.11.18	Link data to and from remote database	P	R	
B 10.11.19	Print reports using data from multiple databases	P	R	
B 10.11.20	Use database files with other application software	P	R	
B 10.11.21	Verify accuracy of output (e.g., edit reports)	P	R	
B 10.11.22	Query databases	P	R	

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EC 10.12.00	Use graphic user interface (GUI) techniques	I	P	
B 10.12.01	Describe a variety of computer interfaces		P	
B 10.12.02	Explain multi-tasking environment		P	
B 10.12.03	Use general navigational skills		P	
B 10.12.04	Use cut and paste functions	I	P	
EC 10.13.00	Manage software packages	I	P	
B 10.13.01	Install software packages		P	
B 10.13.02	Upgrade software packages		P	
B 10.13.03	Document installation and upgrade of software packages		P	
B 10.13.04	Apply security levels/procedures to sensitive data		P	
B 10.13.05	Manage software preferences		P	
B 10.13.06	Manage software conflicts		P	
B 10.13.07	Identify system requirements	I	P	
B 10.13.08	Identify licensing issues	I	P	

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54

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EC 10.14.00	Maintain personal computer systems	I	P	
B 10.14.01	Monitor system status and performance		P	
B 10.14.02	Run diagnostics, utilities, and anti virus		P	
B 10.14.03	Report computer system malfunction(s)	I	P	
B 10.14.04	Report software malfunction(s)	I	P	
B 10.14.05	Identify corrupted files and recovery procedures		P	
B 10.14.06	Maintain security		P	
B 10.14.07	Maintain hardware/software inventory		P	
B 10.14.08	Perform backup procedure(s)		P	
B 10.14.09	Perform preventive maintenance		P	
B 10.14.10	Demonstrate file management techniques		P	
B 10.14.11	Follow log-off and power-down procedure(s)	I	P	
B 10.14.12	Follow equipment maintenance procedures		P	
B 10.14.13	Follow quality control procedures		P	

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EC 10.15.00	Use a shared environment	P	R	C
B 10.15.01	List purposes of a network environment	P	R	
B 10.15.02	Define electronic mail	P	R	
B 10.15.03	Identify advantages and disadvantages of electronic mail	P	R	
B 10.15.04	Describe impact of local & wide area networks on mail delivery	P	R	
B 10.15.05	Compose electronic messages	P	R	
B 10.15.06	Send electronic messages using appropriate format	P	R	
B 10.15.07	List categories of electronic mail service	P	R	
B 10.15.08	Transmit document using electronic mail system	P	R	
B 10.15.09	Use collaboration tools	P	R	
B 10.15.10	Monitor electronic mail	P	R	
B 10.15.11	Use networked environments	P	R	
B 10.15.12	Search database for properties of materials	P	R	
B 10.15.13	Conduct literature searches using a variety of on-line tools	P	R	
B 10.15.14	Explain access, security, transmission and retrieval	P	R	

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50

38

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EC 10.16.00	Demonstrate knowledge of the Internet/Intranet	P	R	C
B 10.16.01	Define the Internet/Intranet	P	R	
B 10.16.02	Explain how the Internet/Intranet works	P	R	
B 10.16.03	Explain Internet/Intranet capabilities and limitations	P	R	
B 10.16.04	Explain how to connect to the Internet/Intranet via modem, ISDN, etc.	P	R	
B 10.16.05	Install Internet/Intranet software	P	R	
B 10.16.06	Navigate the World Wide Web	P	R	
B 10.16.07	Identify services and tools offered on the Internet/Intranet	P	R	
B 10.16.08	Explain bookmarks	P	R	
B 10.16.09	Describe security issues	P	R	
B 10.16.10	Describe ethical use of the Internet/Intranet	P	R	
EC 10.17.00	Use the Internet/Intranet	I	P	C
B 10.17.01	Define how the Internet can be used for research	I	P	
B 10.17.02	Use services and tools offered on the Internet for research	I	P	
B 10.17.03	Identify search engines	I	P	
B 10.17.04	Use search engines	I	P	
B 10.17.05	Evaluate Internet resources and accuracy of information	I	P	
B 10.17.06	Access library catalogs on the Internet		P	
B 10.17.07	Access commercial and government resources		P	
B 10.17.08	Download files	I	P	
B 10.17.09	Use other Internet/Intranet tools and services		P	

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57

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
U 11.00.00	Quality Assurance			
EC 11.01.00	Demonstrate knowledge of quality assurance	I	P	C
B 11.01.01	Explain the ISO 9000 process	I	P	
B 11.01.02	Define quality terms	I	P	
B 11.01.03	Define quality functions		P	
B 11.01.04	Identify features of quality planning		P	
B 11.01.05	Describe control devices used in functional areas (e.g., SPC, equipment)		P	
B 11.01.06	Explain the relationship among organizational structures, policies, procedures, and quality assurance		P	
B 11.01.07	Explain importance of internal and external customers		P	
B 11.01.08	Identify internal and external customers		P	
B 11.01.09	Describe successful efforts by industry to improve quality and/or reduce costs		P	
B 11.01.10	Differentiate between prevention and detection		P	
B 11.01.11	Differentiate between variable and attribute data		P	
B 11.01.12	Identify types of control charts	I	P	
B 11.01.13	Explain how statistical techniques are tools used to control quality (e.g., SPC, DOE, CR)		P	
B 11.01.14	Define cost of quality		P	
EC 11.02.00	Demonstrate knowledge of quality cost implications	I	P	CM
B 11.02.01	Identify cost/quality objectives	I	P	
B 11.02.02	Classify quality costs (e.g., prevention, evaluation, pre-delivery failure, post-delivery failure)		P	
B 11.02.03	Define product liability		P	

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55

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 11.03.00	Demonstrate knowledge of engineering a quality product	I	P	CM
B 11.03.01	Define manufacturability	I	P	
B 11.03.02	Identify steps in product design (e.g., brainstorming, thumbnail sketches, rendering)		P	
EC 11.04.00	Explain importance of interdepartmental relationships to quality assurance	I	P	C
B 11.04.01	Explain need for everyone's commitment in assuring quality		P	
B 11.04.02	Explain continuing improvement	I	P	
EC 11.05.00	Demonstrate knowledge of basic statistics	I	P	CM
B 11.05.01	Describe data collection methods	I	P	
B 11.05.02	Collect data	I	P	
B 11.05.03	Organize data by flow chart		P	
B 11.05.04	Interpret data by cause and effect diagrams		P	
B 11.05.05	Define nominal, ordinal, interval, and ratio data		P	
B 11.05.06	Define mean, median, and mode	I	P	
B 11.05.07	Explain significance of standard deviation		P	
B 11.05.08	Explain normal distribution		P	
B 11.05.09	Identify sampling techniques		P	
EC 11.06.00	Demonstrate knowledge of scattergrams	I	P	CM
B 11.06.01	Construct scattergram	I	P	
B 11.06.02	Interpret for positive, negative, or no correlation between X and Y variables	I	P	

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EC 11.07.00	Demonstrate knowledge of process capability	I	P	M
B 11.07.01	Describe skewed distributions		P	
B 11.07.02	List probable causes of skewed distribution		P	
B 11.07.03	Explain "out of control" situation	I	P	
RC 11.08.00	Interpret X and R charts		I	M
B 11.08.01	Plot percentages for normal distribution		I	
B 11.08.02	Test distribution for normality		I	
B 11.08.03	Explain difference between common cause and special cause		I	
B 11.08.04	Define an "in-control" process		I	
B 11.08.05	Explain significance of an out-of-control point on X or R chart		I	
B 11.08.06	Identify patterns and trends on control chart		I	
B 11.08.07	Identify run up and run down		I	
B 11.08.08	Test for middle third on control chart		I	
B 11.08.09	Explain significance of middle third on control chart		I	
B 11.08.10	Explain Rule of Sevens		I	

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RC 11.09.00	Construct X and R charts		I	M
B 11.09.01	Arrange data into statistical sub-groups		I	
B 11.09.02	Explain importance of random sampling		I	
B 11.09.03	Compute X (e.g., average of values) and R (e.g., range of values in subgroup) within sample		I	
B 11.09.04	Plot in X and R on chart		I	
B 11.09.05	Construct control chart with X (grand average) and R (average range) calculated		I	
B 11.09.06	Calculate upper and lower control limits for X-chart		I	
B 11.09.07	Calculate upper and lower control limits for R-chart		I	
B 11.09.08	Identify various sampling plans and their uses		I	

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EC 11.10.00	Demonstrate knowledge of JIT	I	P	M
B 11.10.01	Define just-in-time concept (JIT)	I	P	
B 11.10.02	Describe various production methodologies (e.g., standard cycle times, routings, standard quantities, multiple-machine tending)	I	P	
B 11.10.03	Describe types of inventory control (e.g., Kanban)		P	
B 11.10.04	Describe importance of flexibility	I	P	
B 11.10.05	Differentiate product layout, process layout, fixed position layout, and cellular layout		P	
B 11.10.06	Differentiate straight-line, U-shaped, S-shaped, convoluted and comb patterns		P	
B 11.10.07	Describe advantages/disadvantages of layout and patterns		P	
B 11.10.08	Explain importance of product protection, identification, and storage		P	
B 11.10.09	List methods of identifying products (e.g., labels, bar codes, radio frequency systems, and magnetic strip systems)		P	
B 11.10.10	Describe manual methods of storage and retrieval		P	
B 11.10.11	Describe automated storage and retrieval systems (ASRS)		P	
B 11.10.12	Describe automated guided vehicle moving systems (AGVS)		P	
EC 11.11.00	Apply JIT	I	P	M
B 11.11.01	Monitor system of physical handling and movement of material in-process and in-storage	I	P	
B 11.11.02	Monitor system of physical handling and movement of finished products		P	
B 11.11.03	Monitor reports of discrepancy or rejects during production process		P	

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EC 11.12.00	Demonstrate knowledge of inspection	I	P	CM
B 11.12.01	Explain purpose of inspection	I	P	
B 11.12.02	Describe scope of inspection		P	
B 11.12.03	Explain purpose of incoming, ongoing, and final inspections	I	P	
B 11.12.04	Explain early detection inspection		P	
B 11.12.05	Explain how statistical process control (SPC) aids inspection		P	
B 11.12.06	Define types of nonconformance		P	
B 11.12.07	Define degrees of nonconformance		P	
B 11.12.08	Define corrective action		P	
B 11.12.09	Describe when to 100% inspect		P	
B 11.12.10	Describe when to sample inspect		P	
B 11.12.11	Describe methods of testing for material properties (e.g., hardness, strength, chemical makeup, flaws, errors in tooling or setup)		P	
B 11.12.12	Define rework, salvage, and scrap		P	
B 11.12.13	Describe ethical decisions an inspector may make	I	P	
B 11.12.14	Identify purposes of computer-automated inspection		P	
B 11.12.15	Explain advantages and limitations of automated inspection		P	
B 11.12.16	Explain disposition of non-conforming material		P	
B 11.12.17	Explain basic foolproofing concept to build inspection into process (e.g., poka-yoke)		P	
B 11.12.18	Use checksheets to organize and record inspection results		P	

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EC 11.13.00	Inspect machinery, materials, and products	I	P	M
B 11.13.01	Demonstrate basic metrology skills		P	
B 11.13.02	Conduct in-process inspection		P	
B 11.13.03	Identify appropriate inspection reports and follow-up		P	
B 11.13.04	Apply geometric tolerancing	I	P	
EC 11.14.00	Demonstrate knowledge of nondestructive testing	I	P	M
B 11.14.01	Describe purpose of nondestructive testing	I	P	
B 11.14.02	Define defects and discontinuities		P	
B 11.14.03	Identify factors contributing to defects and discontinuities		P	
B 11.14.04	Describe ultrasonic testing	I	P	
B 11.14.05	Describe advantages and limitations of ultrasonic testing		P	
B 11.14.06	Describe industrial radiography	I	P	
B 11.14.07	Explain advantages and limitations of penetrant inspection		P	
B 11.14.08	Describe microwave testing		P	
B 11.14.09	Describe holographic inspection		P	
B 11.14.10	Explain choice of most suitable nondestructive test method		P	

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U 12.00.00 Technical Recording and Reporting

EC 12.01.00	Demonstrate proficiency in technical recording	I	P	CMS
B 12.01.01	Describe various documentation procedures	I	P	
B 12.01.02	Interpret specifications or drawings	I	P	
B 12.01.03	Ask open-ended questions	I	P	
B 12.01.04	Record process (e.g., flowchart, step-by-step)	I	P	
B 12.01.05	Identify parameters	I	P	
B 12.01.06	Record accurate, truthful data	I	P	
B 12.01.07	Maintain test logs	I	P	
B 12.01.08	Compile cumulative reference notebook/record	I	P	
B 12.01.09	Measure appropriate parameters	I	P	
B 12.01.10	Draft preventive maintenance and calibration procedures	I	P	

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EC 12.02.00	Demonstrate proficiency in technical reporting	I	P	CMS
B 12.02.01	Use data books and cross reference/technical manuals	I	P	
B 12.02.02	Compose technical memoranda	I	P	
B 12.02.03	Identify type of report or format needed	I	P	
B 12.02.04	Use appropriate format	I	P	
B 12.02.05	Compile relevant data	I	P	
B 12.02.06	Design charts and graphs	I	P	
B 12.02.07	Analyze data	I	P	
B 12.02.08	Draw conclusions	I	P	
B 12.02.09	Explain analytical methods used	I	P	
B 12.02.10	Outline reports	I	P	
B 12.02.11	Write reports	I	P	
B 12.02.12	Present reports	I	P	

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66

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U 13.00.00	Drafting Technology			
EC 13.01.00	Apply basic drafting skills	P	R	M
B 13.01.01	Use drafting equipment, measuring scales, drawing media, drafting instruments and consumable materials	P	R	
B 13.01.02	Identify line types (alphabet of lines)	P	R	
B 13.01.03	Select proper drawing scale, introduction to different types	P	R	
B 13.01.04	Prepare title blocks and other drafting formats	P	R	
B 13.01.05	Apply freehand and other lettering techniques	P	R	
B 13.01.06	Prepare multi-view drawings	P	R	
B 13.01.07	Prepare multi-view sketches	P	R	
B 13.01.08	Prepare orthographic views	P	R	
B 13.01.09	Measure angles	P	R	
B 13.01.10	Draw horizontal, vertical, angular, parallel, and perpendicular lines	P	R	
B 13.01.11	Transfer an angle	P	R	
B 13.01.12	Construct tangent lines (to arcs) and tangent arcs (to arcs)	P	R	
B 13.01.13	Bisect angles and arcs	P	R	
B 13.01.14	Bisect lines	P	R	
B 13.01.15	Divide lines	P	R	
B 13.01.16	Construct three-point circle	P	R	
B 13.01.17	Construct regular hexagon, pentagon, and octagon	P	R	
B 13.01.18	Prepare single-view drawings	P	R	
B 13.01.19	Prepare dimension drawings/working drawings	P	R	
B 13.01.20	Interpret notes and dimensions to determine part	P	R	
B 13.01.21	Draw arcs, circles, and conics	P	R	
B 13.01.22	Transfer measurements	P	R	

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B 13.01.23	Identify current ANSI symbols/standards	P	R	
EC 13.02.00	Apply intermediate drafting skills	P	R	M
B 13.02.01	Apply isometric, oblique and perspective sketching techniques	P	R	
B 13.02.02	Prepare isometric, oblique and perspective sketches	P	R	
B 13.02.03	Prepare sectional views	P	R	
B 13.02.04	Prepare auxiliary views	P	R	
B 13.02.05	Prepare views of drilled and tapped holes, counterbores, countersinks	P	R	
B 13.02.06	Identify a bill of materials	P	R	
B 13.02.07	Dimension drawings per current ANSI standards	P	R	
B 13.02.08	Describe purpose of auxiliary and sectional views	P	R	
EC 13.03.00	Interpret basic prints	P	R	
B 13.03.01	Visualize object from drawing	P	R	
B 13.03.02	Interpret orthographic projections	P	R	
B 13.03.03	Interpret isometric views	P	R	
B 13.03.04	Interpret sectional views	P	R	
B 13.03.05	Interpret detail and assembly drawings	P	R	
B 13.03.06	Interpret dimensions	P	R	
B 13.03.07	Interpret tolerances	P	R	

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63

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EC 13.04.00	Interpret advanced prints	I	P	M
B 13.04.01	Interpret screw thread specifications	I	P	
B 13.04.02	Interpret electrical, pneumatic/hydraulic drawings		P	
B 13.04.03	Interpret schematics		P	
B 13.04.04	Identify structural steel shapes		P	
B 13.04.05	Interpret special symbols	I	P	
EC 13.05.00	Convert dimensions and tolerances	P	R	M
B 13.05.01	Convert dimensions and tolerances from English units to metric units	P	R	
B 13.05.02	Convert dimensions and tolerances from metric units to English units	P	R	

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EC 13.06.00	Demonstrate dimensioning techniques	P	R	M
B 13.06.01	Construct arrowheads using various styles/disciplines	P	R	
B 13.06.02	Apply symbols for surface and texture control	P	R	
B 13.06.03	Add labels/notes to drawing	P	R	
B 13.06.04	Interpret decimal tolerance dimensions	P	R	
B 13.06.05	Dimension arcs	P	R	
B 13.06.06	Dimension angles	P	R	
B 13.06.07	Dimension curves	P	R	
B 13.06.08	Dimension rounded-end shapes	P	R	
B 13.06.09	Dimension spherical objects	P	R	
B 13.06.10	Dimension cylindrical objects	P	R	
B 13.06.11	Dimension cones, pyramids, and prisms	P	R	
B 13.06.12	Dimension features on circular center line	P	R	
B 13.06.13	Dimension theoretical point of intersection	P	R	
B 13.06.14	Dimension object using rectangular coordinate system	P	R	
B 13.06.15	Dimension object using polar coordinate system	P	R	
B 13.06.16	Dimension object using tabular coordinate system	P	R	
B 13.06.17	Dimension object using ordinate dimensioning system	P	R	

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EC 13.07.00	Demonstrate knowledge of basic geometric dimensioning and tolerancing	I	P	
B 13.07.01	Identify geometric characteristics and symbols (i.e., flatness, straightness, circularity, cylindricity, profile of line, profile of surface, perpendicularity, angularity, parallelism, circular runout, total runout, position, concentricity, and symme	I	P	
B 13.07.02	Define maximum material condition	I	P	
B 13.07.03	Define least material condition	I	P	
B 13.07.04	Define regardless of feature size condition	I	P	
B 13.07.05	Describe feature control frames	I	P	
B 13.07.06	Describe datums	I	P	
B 13.07.07	Define flatness	I	P	
B 13.07.08	Define straightness	I	P	
B 13.07.09	Define circularity	I	P	
B 13.07.10	Define cylindricity	I	P	
B 13.07.11	Define profile of line	I	P	
B 13.07.12	Define profile of surface	I	P	
B 13.07.13	Define perpendicularity	I	P	
B 13.07.14	Define angularity	I	P	
B 13.07.15	Define parallelism	I	P	
B 13.07.16	Define circular runout	I	P	
B 13.07.17	Define total runout	I	P	
B 13.07.18	Define true position concept to determine tolerance for location of holes in mating parts	I	P	
B 13.07.19	Interpret GD&T characteristic symbols	I	P	
B 13.07.20	Interpret GD&T supplementary symbols	I	P	
B 13.07.21	Define concentricity	I	P	

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B 13.07.22	Define symmetry	I	P	
EC 13.08.00	Apply geometric dimensioning and tolerancing	I	P	M
B 13.08.01	Interpret decimal tolerance dimensions	I	P	
B 13.08.02	Calculate clearance fit tolerances of mating parts	I	P	
B 13.08.03	Dimension clearance fit tolerances of mating parts	I	P	
B 13.08.04	Calculate interference fit tolerances of mating parts	I	P	
B 13.08.05	Dimension interference fit tolerances of mating parts	I	P	
B 13.08.06	Calculate transitional fit tolerances of mating parts	I	P	
B 13.08.07	Dimension transitional fit tolerances of mating parts	I	P	
B 13.08.08	Calculate tolerances to mating parts using standard fit tables	I	P	
B 13.08.09	Assign tolerances to mating parts using standard fit tables	I	P	
B 13.08.10	Apply positional and form tolerancing symbols	I	P	
B 13.08.11	Apply symbols for true position	I	P	
B 13.08.12	Apply symbols for maximum material control and regardless of feature size and least material condition	I	P	
B 13.08.13	Calculate effects of dimensional stack-up	I	P	
EC 13.09.00	Prepare mechanical drawings	I	P	
B 13.09.01	Interpret basic mechanical standards and symbols	I	P	
B 13.09.02	Prepare drawings with special processed holes	I	P	
B 13.09.03	Prepare assembly drawings		P	

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EC 13.10.00	Apply advanced drafting skills	P	R	
B 13.10.01	Prepare pictorial drawings	P	R	
B 13.10.02	Interpret various drawings (e.g., welding, casting, stamping, forging, civil, maps, pattern shop)	P	R	
B 13.10.03	Interpret reports and specifications	P	R	
B 13.10.04	Prepare schematics	P	R	
EC 13.11.00	Prepare advanced mechanical drawings	I	P	M
B 13.11.01	Resolve problems by descriptive geometry and revolutions		P	
B 13.11.02	Use precision dimensioning to include geometric characters		P	
B 13.11.03	Prepare fastener drawings	I	P	
B 13.11.04	Prepare cam drawings		P	
B 13.11.05	Prepare gear drawings		P	
B 13.11.06	Identify welding symbols	I	P	
B 13.11.07	Prepare a drawing from a part		P	
EC 13.12.00	Apply revision control process	I	P	
B 13.12.01	Apply drawing balloons		P	
B 13.12.02	Apply documentation (including project filing, back-up material, tracking process)		P	
B 13.12.03	Apply change control block		P	
B 13.12.04	Apply revision levels	I	P	

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73

55

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U 14.00.00 Visualization and Design for Function

EC 14.01.00	Deduce by examination function(s) of parts	I	P
B 14.01.01	Identify through examination the function of parts	I	P
B 14.01.02	Explain how function is related to part properties (e.g., geometry, material, finish)		P
EC 14.02.00	Design/prepare computer model objects for function	I	P
B 14.02.01	Develop an alternative design for an existing part	I	P
B 14.02.02	Prepare a computer model of a manufacturing process		P

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74

56

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
U 15.00.00	CADD Fundamentals (The Competencies in this Unit meet or exceed the applicable sections of the National Occupational Skill Standards developed by the National Coalition for Advanced Manufacturing (NACFAM). Sources - CADD - Computer Aided Drafting &			
EC 15.01.00	Demonstrate basic use of computer operating system	P	R	C
B 15.01.01	Explain rules for naming files and directories	P	R	
B 15.01.02	Manage files	P	R	
B 15.01.03	Create directories/subdirectories	P	R	
B 15.01.04	Remove directories/subdirectories	P	R	
B 15.01.05	Change directories/subdirectories	P	R	
B 15.01.06	Copy files	P	R	
B 15.01.07	Rename files	P	R	
B 15.01.08	Erase files	P	R	
B 15.01.09	Format diskettes	P	R	
B 15.01.10	Label diskettes	P	R	
B 15.01.11	Explain the syntax of operating system commands	P	R	
B 15.01.12	Use wildcards in operating system commands	P	R	

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EC 15.02.00	Operate a CADD System	P	R	CM
B 15.02.01	Execute CADD System	P	R	
B 15.02.02	Use keyboard input	P	R	
B 15.02.03	Use screen menus	P	R	
B 15.02.04	Use other input devices (e.g., scanner, digitizer)	P	R	
B 15.02.05	Create scaled plots	P	R	
B 15.02.06	Operate a printer-plotter (i.e., laser plotter)	P	R	
B 15.02.07	Access on-line help for commands	P	R	
B 15.02.08	Use file conversion	P		
B 15.02.09	Use data transfer	P		
EC 15.03.00	Select entities for action	P	R	M
B 15.03.01	Add or remove entities separately	P	R	
B 15.03.02	Add or remove entities using a window	P	R	
B 15.03.03	Add or remove entities with a crossing-box	P	R	
B 15.03.04	Select entities using a fence	P	R	
B 15.03.05	Select entities by other methods (e.g., last, previous, type, all, etc.)	P	R	

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EC 15.04.00	Create 2-D orthographic drawings	P	R	M
B 15.04.01	Create primitive drawing entities	P	R	
B 15.04.02	Create accurate geometry	P	R	
B 15.04.03	Draw utilizing absolute Cartesian coordinates	P	R	
B 15.04.04	Draw utilizing relative Cartesian coordinates	P	R	
B 15.04.05	Draw utilizing polar coordinates	P	R	
B 15.04.06	Draw using construction aids	P	R	
B 15.04.07	Change drawing attributes	P	R	
B 15.04.08	Edit drawing entity properties (e.g., color, layer, thickness, linetype)	P	R	
B 15.04.09	Construct drawing entities	P	R	
B 15.04.10	Edit drawing entities	P	R	
B 15.04.11	Set system variables (e.g., units, scale)	P	R	
B 15.04.12	Use system variables	P	R	
B 15.04.13	Create layers	P	R	
B 15.04.14	Name layers	P	R	
B 15.04.15	Manipulate layers	P	R	
B 15.04.16	Save files	P	R	
B 15.04.17	Create back-ups	P	R	
B 15.04.18	Create hatches, patterns, symbols	P	R	
B 15.04.19	Recall drawing templates/blocks	P	R	

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EC 15.05.00	Annotate orthographic drawings	P	R	C
B 15.05.01	Create text styles	P	R	
B 15.05.02	Edit text styles	P	R	
B 15.05.03	Select text styles	P	R	
B 15.05.04	Apply notes	P	R	
EC 15.06.00	Dimension orthographic drawings	P	R	CM
B 15.06.01	Create dimensions	P	R	
B 15.06.02	Apply consistent dimension standards	P	R	
B 15.06.03	Edit text	P	R	
B 15.06.04	Control dimension variables/models	P	R	
EC 15.07.00	Control display	P	R	M
B 15.07.01	Apply view control while drawing (e.g., zoom and pan)	P	R	
B 15.07.02	Control view resolution	P	R	
B 15.07.03	Save views	P	R	
B 15.07.04	Display views	P	R	
EC 15.08.00	Extract entity and drawing information	P	R	M
B 15.08.01	Measure distances	P	R	
B 15.08.02	Measure areas	P	R	
B 15.08.03	Identify locations	P	R	
B 15.08.04	List entity characteristics (e.g., length, size, location, properties, etc.)	P	R	

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73

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EC 15.09.00	Use external/internal routines	I	P	
B 15.09.01	Export CAD files	I	P	
B 15.09.02	Import CAD files	I	P	
B 15.09.03	Export text/graphics files		P	
B 15.09.04	Import text/graphics files		P	
U 16.00.00	Intermediate CADD			
EC 16.01.00	Manage symbols and attributes	I	P	
B 16.01.01	Create blocks/templates	I	P	
B 16.01.02	Create nested blocks/templates		P	
B 16.01.03	Insert blocks and drawings/templates	I	P	
B 16.01.04	Redefine blocks/templates		P	
B 16.01.05	Edit blocks/templates		P	
B 16.01.06	Create/apply/modify attributes		P	
EC 16.02.00	Create 2-D isometric drawings	P	R	M
B 16.02.01	Manipulate snap and grid settings	P	R	
B 16.02.02	Create text styles for each plane	P	R	
B 16.02.03	Create dimension styles	P	R	
B 16.02.04	Use dimension styles	P	R	
B 16.02.05	Toggle isometric planes	P	R	

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79

61

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U 17.00.00 Advanced CADD

EC 17.01.00	Configure a CADD station	P	R
B 17.01.01	Configure display drivers	P	R
B 17.01.02	Configure printer/plotter drivers	P	R
B 17.01.03	Configure input drivers	P	R

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EC 17.02.00	Create 3-D solid models	I	P	M
B 17.02.01	Delete constraints		P	
B 17.02.02	Add constraints		P	
B 17.02.03	Add dimensions to sketch		P	
B 17.02.04	Change dimensions on sketch		P	
B 17.02.05	Relate dimensions with equations		P	
B 17.02.06	Use global parameters		P	
B 17.02.07	Edit global parameters		P	
B 17.02.08	Define work planes, points, and axes		P	
B 17.02.09	Define sketch planes		P	
B 17.02.10	Create solid primitives		P	
B 17.02.11	Modify solid primitives		P	
B 17.02.12	Create swept solids		P	
B 17.02.13	Use Boolean operations to create complex solids (e.g., unions, subtractions, intersections, separations)		P	
B 17.02.14	Fillet solid models		P	
B 17.02.15	Chamfer solid models		P	
B 17.02.16	Extract mass properties from a solid model		P	
B 17.02.17	Create 2-D profiles and sections from a solid model	I	P	
B 17.02.18	Explain the advantages/limitations of solid modeling		P	
B 17.02.19	Extrude a profile	I	P	
B 17.02.20	Create revolutions		P	
B 17.02.21	Add hole features	I	P	

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RC 17.03.00	Create a parametric solid assembly		P	
B 17.03.01	Import parts		P	
B 17.03.02	Export parts		P	
B 17.03.03	Add constraints		P	
RC 17.04.00	Create a drawing from a parametric solid		P	
B 17.04.01	Define base view		P	
B 17.04.02	Define orthographic views using base views		P	
B 17.04.03	Define isometric view		P	
B 17.04.04	Define auxillary views		P	
B 17.04.05	Define section views		P	
B 17.04.06	Define detail views		P	
B 17.04.07	Define scenes		P	
RC 17.05.00	Dimension a parametric solid drawing		P	
B 17.05.01	Move dimensions		P	
B 17.05.02	Add reference dimensions		P	
B 17.05.03	Freeze and thaw dimensions		P	
B 17.05.04	Define dimension styles and attributes		P	
B 17.05.05	Change dimension styles and attributes		P	
B 17.05.06	Add hole notes		P	
B 17.05.07	Add other annotations		P	
EC 17.06.00	Apply advanced display control	I	P	MS
B 17.06.01	Use clipping planes to section a model		P	
B 17.06.02	Create rendered images of surface and solid models	I	P	

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EC 17.07.00	Prepare electrical/electronic CADD drawings	I	P	
B 17.07.01	Interpret basic electric/electronic standards and symbols	I	P	
B 17.07.02	Prepare schematic drawings	I	P	
B 17.07.03	Prepare cable drawings		P	
B 17.07.04	Prepare component drawings		P	
B 17.07.05	Prepare logic diagrams		P	
B 17.07.06	Prepare control panel drawings	I	P	
B 17.07.07	Prepare connection drawings		P	
B 17.07.08	Prepare interconnection drawings		P	
B 17.07.09	Prepare wiring diagrams		P	
B 17.07.10	Prepare enclosure drawings		P	
EC 17.08.00	Prepare pneumatic/hydraulic CADD drawings	I	P	
B 17.08.01	Interpret basic pneumatic/hydraulic standards and symbols	I	P	
B 17.08.02	Prepare piping drawings	I	P	
B 17.08.03	Prepare isometric drawings		P	
B 17.08.04	Prepare sectional diagrams	I	P	
B 17.08.05	Prepare graphical symbols		P	
B 17.08.06	Prepare process and instrumentation diagrams		P	
B 17.08.07	Prepare pump and motor drawings		P	
B 17.08.08	Prepare cylinder and piston diagrams		P	
B 17.08.09	Prepare valve drawings		P	
B 17.08.10	Prepare pump section drawings		P	

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EC 17.09.00	Prepare structural CADD drawings	I	P	M
B 17.09.01	Use structural and reinforcing concrete manuals and technical tables		P	
B 17.09.02	Detail structural beam connections		P	
B 17.09.03	Detail concrete reinforcements		P	
B 17.09.04	Draw structural framing plans and elevations	I	P	
RC 17.10.00	Create custom linetypes (and menus)	I	I	
B 17.10.01	Formulate a linetype composed of long dashes	I		
B 17.10.02	Formulate a linetype composed of lines, dashes, and dots	I		
B 17.10.03	Demonstrate search routines when using a text editor		I	
B 17.10.04	Write screen menus and macros		I	
B 17.10.05	Write cascading pop-down menus and macros		I	
B 17.10.06	Write other customizable CADD files (e.g., ACADD.PCP)		I	
B 17.10.07	Edit other customizable CADD files (e.g., ACADD.PCP)		I	
EC 17.11.00	Create 3-D models	I	P	
B 17.11.01	Differentiate among extrusions, wireframes, surface models, and solid models	I	P	
B 17.11.02	Create user coordinate systems	I	P	
B 17.11.03	Manipulate user coordinate systems		P	
B 17.11.04	Project geometry from one plane to another		P	
B 17.11.05	Dimension a 3-D model for both isometric and orthographic drawings		P	
B 17.11.06	Control dimension scale with regard to plotting scale		P	

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U 18.00.00	Basic Electricity			
EC 18.01.00	Demonstrate proficiency in electrical fundamentals	P	R	CMS
B 18.01.01	Identify electronic components and schematic symbols	P	R	
B 18.01.02	Describe basic atomic structure and its relationship to electricity	P	R	
B 18.01.03	Describe the relationship between electrical and magnetic properties	P	R	
B 18.01.04	Describe the electrical and magnetic properties of a magnet	P	R	
B 18.01.05	Describe the photoelectric effect	P	R	
B 18.01.06	Describe the thermocouple effect	P	R	
B 18.01.07	Describe the electrical effect of friction	P	R	
B 18.01.08	Use metric units to solve electronic unit problems	P	R	
B 18.01.09	Identify sources of electricity	P	R	
B 18.01.10	Describe principles and operations of electrochemical supplies	P	R	
B 18.01.11	Describe voltage, current, resistance, power and energy	P	R	
B 18.01.12	Apply Ohm's Law	P	R	
B 18.01.13	Apply Kirchoff's Laws	P	R	
B 18.01.14	Apply power formulas	P	R	
B 18.01.15	Interpret color codes and symbols to identify electrical components and values	P	R	
B 18.01.16	Measure properties of circuits using test equipment	P	R	
B 18.01.17	Demonstrate electrostatic discharge (ESD) preventive procedures	P	R	

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EC 18.02.00	Demonstrate proficiency in DC circuits	P	R	CMS
B 18.02.01	Compute conductance of conductors and insulators	P	R	
B 18.02.02	Measure resistance and current of conductors and insulators	P	R	
B 18.02.03	Measure properties of a circuit using volt-ohm meter (VOM) and digital volt-ohm meter (DVM)	P	R	
B 18.02.04	Build series, parallel, and combination circuits	P	R	
B 18.02.05	Build bridge circuits	P	R	
B 18.02.06	Build voltage divider circuits (loaded and unloaded)	P	R	
B 18.02.07	Compute voltage divider circuits (loaded and unloaded)	P	R	
B 18.02.08	Describe magnetic properties of circuits and devices	P	R	
B 18.02.09	Explain physical and electrical characteristics of capacitors and inductors	P	R	
B 18.02.10	Describe RC and RL time constants	P	R	
B 18.02.11	Compute RC and RL time constants	P	R	
B 18.02.12	Operate power supplies for DC circuits	P	R	
B 18.02.13	Describe frequency spectrums	P	R	
B 18.02.14	Use meters and oscilloscopes	P	R	
B 18.02.15	Measure current, voltage, and resistance in DC circuits	P	R	
B 18.02.16	Explain simple DC generator action	P	R	
B 18.02.17	Explain simple DC motor action	P	R	
B 18.02.18	Solve algebraic problems to include exponential (prerequisite to DC) algebraic calculation	P	R	
B 18.02.19	Identify use of circuit protective devices (e.g., fuses, breakers)	P	R	
B 18.02.20	Troubleshoot DC circuits	P	R	
B 18.02.21	Identify classes, voltage ratings and/or polarity of electronic components	P	R	

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EC 18.03.00	Demonstrate proficiency in AC circuits	I	P	CMS
B 18.03.01	Analyze properties of an AC signal	I	P	
B 18.03.02	Describe principles and operation of characteristics of sinusoidal and non-sinusoidal wave forms	I	P	
B 18.03.03	Identify AC sources	I	P	
B 18.03.04	Describe principles and operation of characteristics of capacitive circuits		P	
B 18.03.05	Operate capacitive circuits		P	
B 18.03.06	Describe principles and operation of characteristics of inductive circuits		P	
B 18.03.07	Operate inductive circuits		P	
B 18.03.08	Describe principles and operation of transformers		P	
B 18.03.09	Demonstrate operation of AC circuits utilizing transformers		P	
B 18.03.10	Measure power in AC circuits	I	P	
B 18.03.11	Identify use of circuit protective devices (e.g., fuses, breakers)		P	
B 18.03.12	Describe basic motor theory and operation	I	P	
B 18.03.13	Describe basic generator theory and operation	I	P	
B 18.03.14	Operate power supplies for AC circuits	I	P	
B 18.03.15	Describe principles and operation of various safety grounding systems (e.g., lightning arresters, ground electrostatic discharge, fault interrupters, etc.)		P	
B 18.03.16	Describe characteristics of inductors in series and parallel circuits		P	
B 18.03.17	Describe characteristics of capacitance in series and parallel circuits		P	
B 18.03.18	Compare resistive-capacitive (RC) and resistive-inductive (RL) time constants (TC)		P	
B 18.03.19	Measure voltage, current, time, frequency (f), and phase relationships of AC sine wave signal	I	P	

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B 18.03.20	Describe frequency (F) and phase relationships	I	P	
B 18.03.21	Measure current, voltage, and resistance in AC circuits	I	P	
B 18.03.22	Identify 50/60 Hertz	I	P	
B 18.03.23	Explain simple AC generator action	I	P	
B 18.03.24	Explain simple AC motor action	I	P	
B 18.03.25	Calculate power factor in AC circuits	I	P	
B 18.03.26	Calculate peak (PK), root mean square (RMS), and average values		P	
B 18.03.27	Troubleshoot AC circuits		P	
B 18.03.28	Describe principles and operation of various power conditioning systems (e.g., isolation transformers, surge suppressors, uninterruptable power systems)		P	

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83

70

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**U 19.00.00 Electronics Troubleshooting and Repair
for IM (The Competencies in this Unit meet
or exceed the applicable sections of the
National Occupational Skill Standards
developed by the Electronic Industries
Association and the Electronics Industries
Foundat**

EC 19.01.00	Demonstrate troubleshooting skills	I	P
B 19.01.01	Explain role of preventive maintenance	I	P
B 19.01.02	Differentiate normal and abnormal operations		P
B 19.01.03	Explain troubleshooting procedures	I	P
B 19.01.04	Explain logical actions taken to troubleshoot		P
B 19.01.05	Identify and use proper troubleshooting aids and tools		P
B 19.01.06	Demonstrate knowledge of safety rules for troubleshooting and repair procedures		P
B 19.01.07	Explain troubleshooting and repair records		P
B 19.01.08	Interpret prints		P
B 19.01.09	Use manufacturer's manuals, schematics, and troubleshooting charts	I	P
B 19.01.10	Isolate faults, shorts, and open circuits		P

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EC 19.02.00	Apply troubleshooting and repair techniques to manufacturing systems		P	
B 19.02.01	Identify individual process blocks of assembly line or process		P	
B 19.02.02	Identify process block interfaces		P	
B 19.02.03	Demonstrate steps required for efficient systems troubleshooting		P	
B 19.02.04	Isolate system faults to process block		P	
B 19.02.05	Isolate block faults using schematics		P	
B 19.02.06	Isolate block faults using programmable controller indicators		P	
B 19.02.07	Isolate block faults using volt meter		P	
B 19.02.08	Repair block faults by replacing fault component or wiring		P	

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U 20.00.00 Programmable Logic Controllers (PLCs)

RC 20.01.00 Demonstrate use of PLCs I CMS

B	20.01.01	Draw block diagram of a PLC	I	
B	20.01.02	Define individual blocks of a PLC	I	
B	20.01.03	Use operator's and/or manufacturer's manual(s)	I	
B	20.01.04	Translate relay logic to logic for a PLC	I	
B	20.01.05	Operate timers, counters and sequencers	I	
B	20.01.06	Operate analog I/O modules	I	
B	20.01.07	Write a statement and ladder logic program	I	
B	20.01.08	Document a statement and ladder logic program	I	
B	20.01.09	Use a PLC program	I	

RC 20.02.00 Explain basic operation of PLCs I CM

B	20.02.01	Describe basic applications of PLCs	I	
B	20.02.02	Identify program symbols and language functions	I	
B	20.02.03	Describe function of block transfers	I	
B	20.02.04	Describe operation of timers, counters, and sequences	I	
B	20.02.05	Describe operation of analog I/O modules	I	
B	20.02.06	Describe operation of servo motion control	I	
B	20.02.07	Describe the principles and operation of PLCs	I	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
RC 20.03.00	Differentiate among instrumentation and control		I	CM
B 20.03.01	Describe characteristics associated with automatic controls		I	
B 20.03.02	Define proportional control		I	
B 20.03.03	Define integral control		I	
B 20.03.04	Define derivative control		I	
B 20.03.05	Describe advantages of using proportional, integral or derivative control		I	
B 20.03.06	Describe disadvantages of using proportional, integral or derivative control		I	

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92

74

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
RC 20.04.00	Apply robot fundamentals		I	CM
B 20.04.01	Describe the operation of robotic work cells		I	
B 20.04.02	Operate robotic work cells		I	
B 20.04.03	Troubleshoot robotic work cells		I	
B 20.04.04	Repair robotic work cells		I	
B 20.04.05	Classify robots according to industry criteria		I	
B 20.04.06	Identify robot power drive types		I	
B 20.04.07	Describe positioning in terms of axis, actuators and coordinate system		I	
B 20.04.08	Identify types of control systems and sensors		I	
B 20.04.09	Apply different methods of programming (e.g., teach, off-line)		I	
B 20.04.10	Write simple programs to exercise robot functions		I	
B 20.04.11	Join programs to perform full function		I	
B 20.04.12	Identify principles of robot safety		I	
B 20.04.13	Describe operation of various sensors used in robot control		I	
B 20.04.14	Interface sensors to robot		I	
B 20.04.15	Interface robots		I	
B 20.04.16	Define open loop and closed loop control		I	
B 20.04.17	Design a simple automated system to perform manufacturing operation		I	
B 20.04.18	Identify operation of end-effectors		I	

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U 21.00.00	Industrial Electricity			
EC 21.01.00	Explain basic industrial electricity theory	P	R	CMS
B 21.01.01	Describe atomic structure and its relationship to electricity	P	R	
B 21.01.02	Describe the relationship between electrical and magnetic properties	P	R	
B 21.01.03	Describe the electrical and magnetic properties of a magnet	P	R	
B 21.01.04	Describe the photoelectric effect	P	R	
B 21.01.05	Describe the thermocouple effect	P	R	
B 21.01.06	Describe the electrical effect of friction	P	R	
B 21.01.07	Identify sources of electricity	P	R	
B 21.01.08	Identify potential sources of electricity	P	R	
B 21.01.09	Describe differences between AC/DC	P	R	
B 21.01.10	Describe effects varying degrees of electricity have on the human body	P	R	
EC 21.02.00	Use the National Electrical Code (NEC), International and OSHA Codes	I	P	
B 21.02.01	Use NEC to identify correct materials		P	
B 21.02.02	Use NEC to identify correct methods		P	
B 21.02.03	Use NEC to identify correct applications		P	
B 21.02.04	Use NEC to identify correct safety procedures		P	
B 21.02.05	Identify and use European Economic Commission (EEC) codes		P	
B 21.02.06	Use lock-out, tag-out procedures	I	P	
B 21.02.07	Identify hazardous areas	I	P	

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94

76

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 21.03.00	Explain operation of electrical distribution systems	I	P	S
B 21.03.01	Follow NEC, local, state, and national codes		P	
B 21.03.02	Describe functions of permits and licensing requirements		P	
B 21.03.03	Explain generation of electricity	I	P	
B 21.03.04	Explain transmission of electricity	I	P	
B 21.03.05	Explain end user distribution		P	
EC 21.04.00	Maintain basic electrical systems	P	R	S
B 21.04.01	Replace electrical cords	P	R	
B 21.04.02	Replace batteries	P	R	
B 21.04.03	Replace fuse(s)	P	R	
B 21.04.04	Replace switches and other sensors	P	R	
B 21.04.05	Replace plugs and sockets	P	R	
B 21.04.06	Replace control panel components (e.g., relays, motor starters)	P	R	
B 21.04.07	Replace AC motors (e.g., 3 phase, single phase)	P	R	
B 21.04.08	Replace DC motors	P	R	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
EC 21.05.00	Interpret electrical/electronic drawings	P	R	S
B 21.05.01	Interpret basic electric/electronic standards and symbols (e.g., IEC, IEEE)	P	R	
B 21.05.02	Interpret schematic drawings	P	R	
B 21.05.03	Interpret cable drawings	P	R	
B 21.05.04	Interpret component drawings	P	R	
B 21.05.05	Interpret logic diagrams	P	R	
B 21.05.06	Interpret control panel drawings	P	R	
B 21.05.07	Interpret connection drawings	P	R	
B 21.05.08	Interpret interconnection drawings	P	R	
B 21.05.09	Interpret printed circuit board drawings	P	R	
B 21.05.10	Interpret harness drawings	P	R	
B 21.05.11	Interpret mechanical/electronic production drawings and assembly drawings	P	R	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 21.06.00	Demonstrate proficiency in direct current (DC) circuits	P	R	CMS
B 21.06.01	Describe voltage, current, resistance, power, and energy	P	R	
B 21.06.02	Solve algebraic problems to include exponential (prerequisite to DC)	P	R	
B 21.06.03	Measure properties of a circuit using volt-ohm meter (VOM) and digital volt-ohm meter (DVM) meters and oscilloscopes	P	R	
B 21.06.04	Apply Ohm's Law	P	R	
B 21.06.05	Construct parallel circuits	P	R	
B 21.06.06	Construct series circuits	P	R	
B 21.06.07	Construct series parallel and bridge circuits	P	R	
B 21.06.08	Define voltage divider circuits (loaded and unloaded)	P	R	
B 21.06.09	Construct DC circuits that demonstrate the maximum power transfer theory	P	R	
B 21.06.10	Solve problems in electrical units utilizing metric units	P	R	
B 21.06.11	Describe the principles and operation of electrochemical supplies	P	R	
B 21.06.12	Apply Kirchhoff's laws	P	R	
B 21.06.13	Interpret color codes and symbols to identify electrical components and values	P	R	
B 21.06.14	Measure properties of a circuit using analog and digital meters and oscilloscopes	P	R	
B 21.06.15	Measure conductance and resistance of conductors and insulators	P	R	
B 21.06.16	Describe magnetic properties of circuits and devices	P	R	
B 21.06.17	Describe the physical and electrical characteristics of capacitors and inductors	P	R	
B 21.06.18	Describe RC and RL time constants	P	R	
B 21.06.19	Set up power supplies for DC circuits	P	R	

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97

79

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
B 21.06.20	Operate power supplies for DC circuits	P	R	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
EC 21.07.00	Demonstrate proficiency in alternating current (AC) circuits	I	P	CMS
B 21.07.01	Solve basic trigonometric problems as applicable to electricity (prerequisite to AC)		P	
B 21.07.02	Analyze AC signals utilizing VOM, DVM, oscilloscope, frequency counter, and function generator		P	
B 21.07.03	Analyze power in AC circuits		P	
B 21.07.04	Measure power in AC circuits		P	
B 21.07.05	Operate capacitor and inductor analyzers for AC circuits		P	
B 21.07.06	Analyze properties of an AC signal		P	
B 21.07.07	Describe the principles and operation of the characteristics of sinusoidal and non-sinusoidal wave forms	I	P	
B 21.07.08	Identify AC sources	I	P	
B 21.07.09	Describe the principles and operation of the characteristics of capacitive circuits		P	
B 21.07.10	Demonstrate the operation of capacitive circuits		P	
B 21.07.11	Describe the principles and operation of the characteristics of inductive circuits		P	
B 21.07.12	Demonstrate the operation of inductive circuits		P	
B 21.07.13	Describe the principles and operation of the principles of transformers	I	P	
B 21.07.14	Demonstrate the operation of AC circuits utilizing transformers		P	
B 21.07.15	Operate differentiators and integrators to determine RC and RL time constants		P	
B 21.07.16	Describe the principles and operation of the characteristics of RLC circuits (series, parallel, and complex)		P	
B 21.07.17	Demonstrate the operation of RLC circuits (series, parallel, and complex)		P	
B 21.07.18	Describe the principles and operation of the characteristics of series and parallel resonant circuits		P	

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B 21.07.19	Operate series and parallel resonant circuits		P	
B 21.07.20	Describe the principles and operation of the characteristics of frequency selective filter circuits		P	
B 21.07.21	Demonstrate the operation of frequency selective filter circuits		P	
B 21.07.22	Operate polyphase circuits		P	
B 21.07.23	Describe basic motor theory and operation		P	
B 21.07.24	Describe basic generator theory and operation		P	
B 21.07.25	Operate power supplies for AC circuits		P	
B 21.07.26	Describe the principles and operation of various power conditioning (e.g., isolation transformers, surge suppressors, uninterruptable power systems)		P	
B 21.07.27	Describe the principles and operation of various safety grounding systems (e.g., lightning arresters, ground fault interrupters)		P	
B 21.07.28	Apply maximum power transfer theorems		P	
B 21.07.29	Identify harmonics problems		P	
B 21.07.30	Correct harmonics problems		P	

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U 22.00.00	Electrical Test and Measurement Equipment			
EC 22.01.00	Demonstrate proficient use of electrical test equipment	I	P	CMS
B 22.01.01	Apply test equipment to DC circuits	I	P	
B 22.01.02	Apply test equipment to AC circuits	I	P	
EC 22.02.00	Demonstrate proficient use of electrical measurement equipment	P	R	CMS
B 22.02.01	Describe function and operation of analog volt-ohm-meter (AVOM)	P	R	
B 22.02.02	Describe function and operation of digital volt-ohm-meter (DVOM)	P	R	
B 22.02.03	Describe function and operation of oscilloscopes	P	R	
B 22.02.04	Apply measurement equipment to DC circuits	P	R	
B 22.02.05	Apply measurement equipment to AC circuits	P	R	
B 22.02.06	Describe function and operation of clamp-on amp meter	P	R	

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U 23.00.00	Equipment Installation			
EC 23.01.00	Explain installation procedures	I	P	C
B 23.01.01	Explain relocation procedures for new equipment in an existing facility		P	
B 23.01.02	Explain the use of anchors and isolators		P	
B 23.01.03	Explain procedures for moving and installing new equipment	I	P	
B 23.01.04	Explain leveling and aligning procedures	I	P	
B 23.01.05	Explain test run guidelines		P	
B 23.01.06	Explain safety precautions for equipment installation procedures		P	
B 23.01.07	Explain grounding procedures		P	
B 23.01.08	Explain installation of utilities (e.g., electricity, air, water, drains)		P	
EC 23.02.00	Prepare for equipment installation	I	P	CMS
B 23.02.01	Calculate weights	I	P	
B 23.02.02	Revise drawings if applicable		P	
B 23.02.03	Interpret prints		P	
EC 23.03.00	Install Equipment	I	P	CMS
B 23.03.01	Calculate weight	I	P	
B 23.03.02	Follow manufacturer's specifications		P	
B 23.03.03	Align equipment to layout specifications		P	

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102

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
EC 23.04.00	Explain rigging functions	I	P	CMS
B 23.04.01	Estimate the weight of a load		P	
B 23.04.02	Find the center of gravity	I	P	
B 23.04.03	Identify cranes and hoists	I	P	
EC 23.05.00	Perform rigging functions	I	P	CM
B 23.05.01	Perform safety inspection procedures for rigging, ropes, and slings	I	P	
B 23.05.02	Rig safety harness and nets		P	

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U 24.00.00 Equipment Maintenance

EC 24.01.00	Perform housekeeping	P	R	C
B 24.01.01	Dispose of scrap metal chips, shavings, trash and waste	P	R	
B 24.01.02	Clean work area	P	R	
B 24.01.03	Store hand tools, cutters, fixtures, jigs, and attachments	P	R	
B 24.01.04	Store grinding wheels	P	R	
B 24.01.05	Follow tool crib procedures	P	R	
B 24.01.06	Inspect machine guards	P	R	
B 24.01.07	Replace or adjust machine guards	P	R	
B 24.01.08	Report problems to supervisor	P	R	
EC 24.02.00	Perform recordkeeping	P	R	CM
B 24.02.01	Explain reasons for keeping maintenance records	P	R	
B 24.02.02	Explain reasons for keeping cost records	P	R	
B 24.02.03	Complete work order	P	R	
B 24.02.04	Complete time cards	P	R	
B 24.02.05	Record preventive maintenance activities	P	R	
B 24.02.06	Record repair activities	P	R	
B 24.02.07	Read job orders and process sheets	P	R	
B 24.02.08	Locate tooling and set up information	P	R	
B 24.02.09	File reports	P	R	

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EC 24.03.00	Inspect machine systems	P	R	C
B 24.03.01	Explain planned maintenance	P	R	
B 24.03.02	Explain predictive maintenance measures	P	R	
B 24.03.03	Explain preventive maintenance measures (e.g., lubrication)	P	R	
B 24.03.04	Explain machine system(s) calibration	P	R	
B 24.03.05	Inspect linkages and lever mechanisms	P	R	
B 24.03.06	Inspect drive couplings	P	R	
B 24.03.07	Inspect clutches	P	R	
B 24.03.08	Inspect roller ball bearings	P	R	
B 24.03.09	Inspect safety systems	P	R	
B 24.03.10	Make minor adjustments/repairs	P	R	
EC 24.04.00	Perform machine maintenance	P	R	C
B 24.04.01	Use operator's and manufacturer's manuals	P	R	
B 24.04.02	Operate individual machines	P	R	
B 24.04.03	Clean equipment	P	R	
B 24.04.04	Lubricate equipment	P	R	
B 24.04.05	Make minor adjustments to equipment	P	R	

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EC 24.05.00	Maintain and properly use hand tools	I	P	CMS
B 24.05.01	Demonstrate use and care of measuring devices (e.g., rules, tapes, calipers, micrometers, multimeter, thermometer, and coordinate measuring system)	I	P	
B 24.05.02	Demonstrate use and care of equipment used to bend and assemble rigid conduit and tubing		P	
B 24.05.03	Demonstrate use and care of common hand tools		P	
B 24.05.04	Demonstrate use and care of wood working tools (e.g., saws, planes, drills, hammers)		P	
B 24.05.05	Demonstrate use and care of sheet metal tools (e.g., sheet metal gauges, hand seamers, soldering irons)		P	
B 24.05.06	Demonstrate proper metal working bench skills (including use of vices, hacksaws, files, tapes, dies, and reamers)	I	P	
B 24.05.07	Demonstrate use and care of pipe clearing equipment		P	
EC 24.06.00	Maintain and properly use portable power tools	I	P	C
B 24.06.01	Demonstrate use and care of light-duty and heavy-duty drills	I	P	
B 24.06.02	Demonstrate use and care of electric hammers		P	
B 24.06.03	Demonstrate use and care of pneumatic drills and hammers		P	
B 24.06.04	Demonstrate use and care of power screwdrivers and impact wrenches		P	
B 24.06.05	Demonstrate use and care of linear motion saws		P	
B 24.06.06	Demonstrate use and care of circular saws	I	P	
B 24.06.07	Demonstrate use and care of routers and planes		P	
B 24.06.08	Demonstrate use and care of belt, pad, and disc sanders		P	
B 24.06.09	Demonstrate use and care of grinders and shears	I	P	
B 24.06.10	Demonstrate use and care of explosive actuated tools		P	
B 24.06.11	Demonstrate use and care of electric lifts		P	

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EC 24.07.00	Maintain and properly use stationary equipment	I	P	C
B 24.07.01	Demonstrate use and care of mechanical presses		P	
B 24.07.02	Demonstrate use and care of hydraulic presses		P	
B 24.07.03	Demonstrate use and care of drill presses	I	P	
B 24.07.04	Demonstrate use and care of bench grinders	I	P	
B 24.07.05	Demonstrate use and care of power saws (e.g., hack, cut-off, chop, band, jig, and table)		P	
B 24.07.06	Demonstrate use and care of band saws	I	P	
B 24.07.07	Demonstrate use and care of pipe threaders		P	
B 24.07.08	Demonstrate use and care of metal brakes		P	
B 24.07.09	Demonstrate use and care of power shears		P	

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U 25.00.00 Industrial Engineering Basics

EC 25.01.00	Apply knowledge of workstation design	I	P
B 25.01.01	Participate in development of overall plant layout	I	P
B 25.01.02	Identify minimal movement of materials and parts throughout production line	I	P
B 25.01.03	Plan operator's access to materials and tools		P
B 25.01.04	Eliminate unnecessary body moves (e.g., bends, turns, stoops, hand movements)		P
B 25.01.05	Identify physical safety items (e.g., equipment, temperature, fumes, light)		P
B 25.01.06	Identify methods to prevent operator from reaching across moving parts		P
B 25.01.07	List type of material handling equipment for operation	I	P
B 25.01.08	Calculate bench space needs for process and storage		P
B 25.01.09	Calculate machine controls to position operator efficiently		P
B 25.01.10	Physically simulate operation		P
B 25.01.11	Review total process for simplification		P

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 25.02.00	Demonstrate knowledge of ergonomics	I	P	CMS
B 25.02.01	Define ergonomics	I	P	
B 25.02.02	Identify risk factors		P	
B 25.02.03	Define maximum permissible limit (MPL) and action limit (AL) for lifting		P	
B 25.02.04	Define cumulative trauma disorder (CTD)		P	
B 25.02.05	Identify susceptibility factors for CTD		P	
B 25.02.06	Identify need for mats and footrest for standing jobs	I	P	
B 25.02.07	Identify need for appropriate working heights of chairs, stools, workbenches, equipment		P	
B 25.02.08	Identify need for adequate lighting	I	P	
B 25.02.09	Explain use of anthropometric design		P	
B 25.02.10	Explain use of rest pauses		P	
B 25.02.11	Minimize extreme joint movement		P	
B 25.02.12	Minimize use of excessive muscle force		P	
B 25.02.13	Minimize repetitive tasks		P	
B 25.02.14	Minimize mechanical stresses (e.g., sharp edges, heat, cold, hard surfaces, weights, vibration)		P	
B 25.02.15	Minimize awkward body positions		P	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
EC 25.03.00	Apply knowledge of methods engineering	I	P	CMS
B 25.03.01	Define methods engineering		P	
B 25.03.02	Define goals of methods engineering (e.g., quality, increase productivity, decrease per unit cost)		P	
B 25.03.03	Set sequence of production operations		P	
B 25.03.04	Set sequence of needed inspections		P	
B 25.03.05	Recommend methods to shorten process time		P	
B 25.03.06	Recommend alternate operations	P		
B 25.03.07	Recommend ways to eliminate operations	I	P	
B 25.03.08	Ascertain if operations can be performed within facilities		P	
B 25.03.09	Test machine capability	I	P	
B 25.03.10	Follow documentation procedures	I	P	

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110

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
EC 25.04.00	Apply knowledge of standards engineering	I	P	CMS
B 25.04.01	Estimate times by computer simulation		P	
B 25.04.02	Use predetermined time system (e.g., MTM family)		P	
B 25.04.03	Use work sampling		P	
B 25.04.04	Define reach, grasp, move position, turn, apply pressure, and release		P	
B 25.04.05	Define standard time		P	
B 25.04.06	Define performance rating		P	
B 25.04.07	Define allowances		P	
B 25.04.08	Identify leveling factors (e.g., skill levels, effort, work area conditions, consistency)		P	
B 25.04.09	Identify allowance factors (e.g., fatigue, delay, personal)		P	
B 25.04.10	Calculate production rate	I	P	
B 25.04.11	Write job description data	I	P	
B 25.04.12	Complete job status reports	I	P	
B 25.04.13	Analyze job evaluation data		P	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
U 26.00.00	Industrial Manufacturing Technology			
EC 26.01.00	Describe industrial manufacturing process	I	P	CMS
B 26.01.01	Develop flow chart and process sheets	I	P	
B 26.01.02	Explain need for manufacturing documentation (e.g., ISO 9000)	I	P	
B 26.01.03	Define quality process	I	P	
B 26.01.04	Identify safety related items		P	
B 26.01.05	Explain techniques of measuring motion, forces, voltage, current, power, distance, time and temperature		P	
B 26.01.06	Explain mechanical and chemical properties of ferrous and non-ferrous metals		P	
B 26.01.07	Explain industrial manufacturing process		P	
B 26.01.08	Explain industrial use of non-metallic solids (e.g., ceramics, polymers), liquids, and gases		P	
B 26.01.09	Explain preventive maintenance and calibration procedures		P	
EC 26.02.00	Demonstrate knowledge of Materials Requirements Planning (MRP)	I	P	CMS
B 26.02.01	Define materials requirements planning	I	P	
B 26.02.02	Explain importance of maintaining and controlling inventory (e.g., quantity, price, quality, minimal lot sizes, and timeliness)	I	P	
B 26.02.03	Define master production schedule and bill of materials	I	P	
B 26.02.04	Explain inventory carrying cost and economic order quantity	I	P	
B 26.02.05	Describe the use of the computer in MRP	I	P	
B 26.02.06	Calculate net requirements	I	P	

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112

94

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 26.03.00	Demonstrate knowledge of Material Supply Process (MSP)	I	P	C
B 26.03.01	Describe role of purchase requisitions	I	P	
B 26.03.02	Describe role of material specifications	I	P	
B 26.03.03	Describe role of quality parameters	I	P	
B 26.03.04	Define supplier certification rating methods	I	P	
B 26.03.05	Describe role of source inspector	I	P	
B 26.03.06	Describe role of receiving	I	P	
EC 26.04.00	Demonstrate knowledge of plant layouts	I	P	CM
B 26.04.01	Describe the importance of flexibility	I	P	
B 26.04.02	Differentiate among product layout, process layout, fixed position layout, and cellular layout	I	P	
B 26.04.03	Describe the type of production suited to each layout	I	P	
B 26.04.04	Describe advantages and disadvantages of each layout	I	P	
B 26.04.05	Describe importance of flexibility of material flow	I	P	
B 26.04.06	Differentiate straight-line, U-shaped, S-shaped, convoluted and comb patterns	I	P	
B 26.04.07	Describe advantages and disadvantages of each pattern	I	P	

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RC 26.05.00	Demonstrate knowledge of pre- and post-production control		P	
B 26.05.01	Explain importance of product protection, identification and storage		P	
B 26.05.02	Describe methods of identifying products (e.g., labels, bar codes, radio frequency systems and magnetic strip systems)		P	
B 26.05.03	Describe manual methods of storage and retrieval		P	
B 26.05.04	Describe automated storage and retrieval systems (ASRS)		P	
B 26.05.05	Describe automated guided vehicle moving systems (AGVS)		P	
B 26.05.06	List the types and advantages of available AGVS		P	

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114

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
RC 26.06.00	Demonstrate knowledge of various advanced manufacturing technologies		P	
B 26.06.01	Explain the major defining and functional characteristics of Automated Assembly		P	
B 26.06.02	Demonstrate knowledge of the principles and product design features of Automated Assembly by determining the suitability of a product candidate for Automated Assembly		P	
B 26.06.03	Explain the major defining and functional characteristics of Group Technology		P	
B 26.06.04	Demonstrate an understanding of Group Technology principles in coding products using one of the standard coding systems		P	
B 26.06.05	Explain the major defining and functional characteristics of Simulation		P	
B 26.06.06	Explain where Simulation can be used appropriately as a tool in today's manufacturing systems		P	
B 26.06.07	Explain the major defining and functional characteristics of Lasers	I	P	
B 26.06.08	Explain the major defining and functional characteristics of the principles of Automation		P	
B 26.06.09	Perform discrete part manufacture break-even analysis and economic lot size calculations to determine the appropriate type of manufacturing process		P	
B 26.06.10	Explain the major defining and functional characteristics of Flexible Manufacturing Cells and Flexible Manufacturing Systems	I	P	
B 26.06.11	Perform "what-if" computerized analysis of the changes in lot size, equipment, and manpower on the performance of flexible manufacturing cells and systems		P	
B 26.06.12	Explain the major defining and functional characteristics of Computer Integrated Manufacturing		P	

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115

97

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
RC 26.07.00	Apply robot fundamentals			P
B 26.07.01	Describe the operation of robotic work cells	I		P
B 26.07.02	Operate a robot single tasking			P
B 26.07.03	Troubleshoot robotic functions			P
B 26.07.04	Classify robots according to industry criteria			P
B 26.07.05	Identify robot power drive types			P
B 26.07.06	Describe positioning in terms of axis, actuators, and coordinate system			P
B 26.07.07	Identify types of control systems and sensors			P
B 26.07.08	Apply different methods of programming (e.g., teach, off-line)			P
B 26.07.09	Write simple programs to exercise robot functions			P
B 26.07.10	Identify principles of robot safety			P
B 26.07.11	Describe operation of various sensors used in robot control			P
B 26.07.12	Interface sensors to robot			P
B 26.07.13	Define open loop and closed loop control			P
B 26.07.14	Design a simple automated system to perform manufacturing operation			P
B 26.07.15	Identify operation of end-effectors			P

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116

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
EC 26.08.00	Apply statistical process control techniques	I	P	CM
B 26.08.01	Explain the "how" of project selection	I	P	
B 26.08.02	Explain the "how" of project implementation	I	P	
B 26.08.03	Explain the "how" of project evaluation	I	P	
B 26.08.04	Explain the "how" of planning continuing improvement	I	P	
B 26.08.05	Describe (SPC) statistical process control and its applications		P	
B 26.08.06	Describe a sampling plan		P	
B 26.08.07	Inspect parts for necessary data		P	
B 26.08.08	Plot on appropriate control charts		P	
B 26.08.09	Explain the "how" of planning predictive maintenance		P	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
RC 26.09.00	Manufacture a new or existing product using all aspects of the total manufacturing cycle	I	P	
B 26.09.01	Evaluate product to be manufactured	I	P	
B 26.09.02	Do reverse assembly, if existing product		P	
B 26.09.03	Prepare process sheets/set-up sheets	I	P	
B 26.09.04	Make parts drawings and bill-of-material	I	P	
B 26.09.05	Analyze individual components or sub-assemblies for possible material, design, or process change to reduce cost or to meet any performance, dimensional, or quality requirements	I	P	
B 26.09.06	Demonstrate teamwork skills	I	P	
B 26.09.07	Finalize purchased components and services, including establishing lead times and costs	I	P	
B 26.09.08	Place orders for just-in-time delivery and for raw materials for in-house manufacture	I	P	
B 26.09.09	Manufacture in-house components	I	P	
B 26.09.10	Inspect in-house manufactured components	I	P	
B 26.09.11	Inspect purchased components as received	I	P	
B 26.09.12	Assemble product, including inspection and testing	I	P	
B 26.09.13	Finish product	I	P	
B 26.09.14	Package product	I	P	
B 26.09.15	Prepare product for shipping	I	P	
B 26.09.16	Determine total cost of manufacture of the product	I	P	

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118

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
U 27.00.00	Basic Materials Science			
EC 27.01.00	Demonstrate basic knowledge of metallurgy	I	P	CMS
B 27.01.01	Define metallurgy	I	P	
B 27.01.02	Define metal forming (e.g., general process)	I	P	
B 27.01.03	Identify forming industries (e.g., stamping, forging, fabricating)	I	P	
B 27.01.04	Describe metal forming principles	I	P	
B 27.01.05	Describe the metal forming process	I	P	
B 27.01.06	Identify frequently used metals	P	R	
B 27.01.07	Describe the crystalline structures of metals	I	P	
B 27.01.08	List common chemical properties of metals (i.e., corrosion)	I	P	
B 27.01.09	List common physical properties of metals (i.e., heat, electrical conductivity)	I	P	
B 27.01.10	Describe measures of metal strength	I	P	
B 27.01.11	Identify examples of raw materials processed by hot rolling, cold rolling, forging, drawing, extrusion, spinning and powered metallurgy	I	P	
B 27.01.12	Explain secondary finishing operations (e.g., paint, anodizing)	I	P	
EC 27.02.00	Demonstrate basic knowledge of heat treatment	I	P	CMS
B 27.02.01	Describe process of heat treating	I	P	
B 27.02.02	Define types of heat treating (e.g., case hardening, annealing, drawing, stress relieving, tempering, quenching, critical temperature)	I	P	

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EC 27.03.00	Demonstrate basic knowledge of metal characteristics and formability	I	P	CMS
B 27.03.01	Explain metal and formability basics	I	P	
B 27.03.02	Explain metal grades	I	P	
B 27.03.03	Explain tensile test	I	P	
B 27.03.04	Explain R-value test		P	
B 27.03.05	Explain hardness test	P	R	
B 27.03.06	Explain interpretation of metal characteristics tests	I	P	
B 27.03.07	Describe blank/die interactions (e.g., friction)	I	P	
B 27.03.08	Describe friction and forming process	I	P	
B 27.03.09	Describe circle grid basics		P	
B 27.03.10	Describe the documentation process	I	P	
B 27.03.11	Explain metal coatings	I	P	
EC 27.04.00	Demonstrate basic knowledge of casting	I	P	CMS
B 27.04.01	Identify frequently used metals	I	P	
B 27.04.02	Describe crystalline structure of metals	I	P	
B 27.04.03	List chemical properties of common metals	I	P	
B 27.04.04	List physical properties of common metals	I	P	
B 27.04.05	Define permanent mold casting	I	P	
B 27.04.06	Define shell mold casting	I	P	
B 27.04.07	Define sand casting and pattern making	I	P	
B 27.04.08	Define die casting	I	P	
B 27.04.09	Identify basic casting terms	I	P	
B 27.04.10	Identify advantages/disadvantages of casting processes	I	P	

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100

102

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 27.05.00	Demonstrate basic knowledge of iron and its alloys	I	P	CMS
B 27.05.01	Define iron and its alloys	I	P	
B 27.05.02	Describe iron manufacturing process	I	P	
B 27.05.03	Describe the structure of iron and its alloys	I	P	
B 27.05.04	List chemical properties of iron and its alloys	I	P	
B 27.05.05	List physical properties of iron and its alloys	I	P	
B 27.05.06	Describe iron and alloys property variables	I	P	
B 27.05.07	Describe measures of strength for iron and its alloys	I	P	
B 27.05.08	Identify examples of iron and its alloys processed by hot rolling, stamping, cold rolling, drawing, extrusion, spinning, casting, forging and machining	I	P	
B 27.05.09	Perform tensile test	I	P	
B 27.05.10	Perform hardness test	P	R	
EC 27.06.00	Demonstrate basic knowledge of aluminum and its alloys	I	P	CMS
B 27.06.01	Define aluminum and its alloys	I	P	
B 27.06.02	Describe aluminum manufacturing process	I	P	
B 27.06.03	Describe the structure of aluminum	I	P	
B 27.06.04	List chemical properties of aluminum	I	P	
B 27.06.05	List physical properties of aluminum	I	P	
B 27.06.06	Describe aluminum property variables	I	P	
B 27.06.07	Identify examples of aluminum processed by cold rolling, drawing, extrusion, stamping, spinning, casting, forging and machining	I	P	
B 27.06.08	Perform tensile test	I	P	
B 27.06.09	Perform hardness test	P	R	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 27.07.00	Demonstrate basic knowledge of copper and its alloys (e.g., brass, bronze)	I	P	CMS
B 27.07.01	Define copper and its alloys	I	P	
B 27.07.02	Describe copper manufacturing process	I	P	
B 27.07.03	Describe the structure of copper	I	P	
B 27.07.04	List chemical properties of copper	I	P	
B 27.07.05	List physical properties of copper	I	P	
B 27.07.06	Describe copper property variables	I	P	
B 27.07.07	Describe measures of copper strength	I	P	
B 27.07.08	Identify examples of copper processed by cold rolling, drawing, extrusion, stamping, spinning, casting, forging and machining	I	P	
B 27.07.09	Perform tensile test	I	P	
B 27.07.10	Perform hardness test	P	R	

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122

104

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 27.08.00	Demonstrate basic knowledge of plastics and polymers (including rubber)	I	P	CMS
B 27.08.01	Define plastics and polymers	I	P	
B 27.08.02	Describe plastics, polymers, and composite preparation manufacturing processes	I	P	
B 27.08.03	Describe structure of plastics and polymers	I	P	
B 27.08.04	List common chemical properties of plastics and polymers	I	P	
B 27.08.05	List common physical properties of plastics and polymers	I	P	
B 27.08.06	Differentiate thermoset and thermoplastic	I	P	
B 27.08.07	Describe plastics and polymer property variables	I	P	
B 27.08.08	Describe measure of plastic and polymer strength	I	P	
B 27.08.09	Identify examples of raw materials processed by machining, extrusion, stamping, injection molding, compression molding, injection compression molding, rotational, and blow molding	I	P	
B 27.08.10	Identify molding defect (e.g., flash, sink marks, warp, contamination, wet material, stuck parts, short shot, burn marks, surface blemishes)	I	P	
B 27.08.11	Identify secondary operations performed on plastic parts (e.g., plating, milling, painted)	I	P	
B 27.08.12	Perform tensile, impact, flexural, and flame resistance tests		P	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
EC 27.09.00	Demonstrate basic knowledge of concrete	I	P	CMS
B 27.09.01	Describe the formation of concrete		P	
B 27.09.02	List types of cements and their uses	I	P	
B 27.09.03	Define qualities of concrete (e.g., strength, consistency, homogeneity, tensile force, abrasion, heat of hydration, and heat and sulfate resistance)		P	
B 27.09.04	List tests used in concrete production (e.g., slump test, test of fineness modules)	I	P	
B 27.09.05	List protective practices used after pouring		P	
B 27.09.06	Describe concrete tools and applications (e.g., float, chairs)		P	
EC 27.10.00	Demonstrate basic knowledge of ceramics and composites	I	P	CMS
B 27.10.01	Explain ceramic tools and applications	I	P	
B 27.10.02	Describe the manufacturing of ceramic and composites components	I	P	
B 27.10.03	List tests used to evaluate ceramic and composites components		P	
B 27.10.04	Describe physical and chemical properties of ceramics and composites		P	
B 27.10.05	List ingredients of ceramic products		P	
EC 27.11.00	Demonstrate knowledge of corrosion and protection	I	P	CMS
B 27.11.01	Identify causes of corrosion	I	P	
B 27.11.02	List solutions to minimize problems	I	P	

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124

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
EC 27.12.00	Demonstrate basic knowledge of rubber manufacturing	I	P	CMS
B 27.12.01	Explain history of rubber industry	I	P	
B 27.12.02	Compare properties of natural rubber with those of synthetic rubber	I	P	
B 27.12.03	Explain vulcanization, mastication, and cure systems		P	
B 27.12.04	Explain use of compounding ingredients (e.g., carbon blacks, accelerators, fillers, antioxidants)		P	
B 27.12.05	Explain press and autoclave curing		P	
B 27.12.06	Explain how synthetic rubber is manufactured (e.g., neoprene, butyl, styrene-butadiene)		P	
B 27.12.07	Explain rubber testing (e.g., tensile, durometer)		P	

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125

107

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
U 28.00.00	Mechanical Power Transmission			
EC 28.01.00	Demonstrate knowledge of basic mechanics	I	P	CMS
B 28.01.01	Explain working forces of torque, tension, and compression	I	P	
B 28.01.02	Explain the laws of motion	I	P	
B 28.01.03	Explain how to calculate work in several ways	I	P	
B 28.01.04	Explain the function of simple machines including levers, inclined plane, wedge, wheel and axle, pulley and screw, gears	I	P	
B 28.01.05	Explain the types of power and the method of producing power	I	P	
B 28.01.06	Explain the laws of friction	I	P	
B 28.01.07	Explain mechanical efficiency	I	P	
B 28.01.08	Apply basic knowledge of physics	I	P	
B 28.01.09	Apply basic knowledge of stress, strain and fatigue		P	
B 28.01.10	Calculate speed changes	I	P	

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126

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
EC 28.02.00	Describe mechanical power transmission systems	I	P	MS
B 28.02.01	Describe the principles and operations of compound and reverted gear trains		P	
B 28.02.02	Describe the principles and operations of internal and planetary gear trains		P	
B 28.02.03	Describe the principles and operations of helical and bevel gear trains		P	
B 28.02.04	Describe the principles and operations of rack and pinion, worm and wheel, and block and screw mechanisms		P	
B 28.02.05	Describe the principles and operations of counter rotating mechanisms and differentials		P	
B 28.02.06	Describe the principles and operations of spring mechanisms, pulley blocks and differentials		P	
B 28.02.07	Describe the principles and operations of chain, belt and disc drives and universal joints	I	P	
B 28.02.08	Describe the principles and operations of clutch and coupling mechanisms	I	P	
B 28.02.09	Describe the principles and operations of braking mechanisms	I	P	
B 28.02.10	Describe the necessity for proper alignment and fit of mechanical devices		P	
B 28.02.11	Describe the necessity for proper balance of system components		P	
B 28.02.12	Describe proper component matching (e.g., sheave sets, gear sets)		P	

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127

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
EC 28.03.00	Use bearings	I	P	MS
B 28.03.01	Define bearing	I	P	
B 28.03.02	Identify types of bearings and their applications	I	P	
B 28.03.03	Identify installation method		P	
B 28.03.04	Install bearings		P	
B 28.03.05	Maintain bearings (e.g., lubrication)		P	
B 28.03.06	Remove bearings		P	
B 28.03.07	Identify bearing failure modes		P	
B 28.03.08	Select bearings		P	
B 28.03.09	Design mounting for bearings		P	
EC 28.04.00	Use seals	I	P	MS
B 28.04.01	Define seal	I	P	
B 28.04.02	Identify types of seals and their applications	I	P	
B 28.04.03	Identify installation method		P	
B 28.04.04	Install seals		P	
B 28.04.05	Maintain seals		P	
B 28.04.06	Remove seals		P	
B 28.04.07	Identify seal failure modes		P	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 28.05.00	Use sheaves	I	P	MS
B 28.05.01	Define sheaves	I	P	
B 28.05.02	Identify types, tolerances, and materials of sheaves and their applications	I	P	
B 28.05.03	Identify installation method		P	
B 28.05.04	Install sheaves		P	
B 28.05.05	Maintain sheaves		P	
B 28.05.06	Remove sheaves		P	
B 28.05.07	Identify failure modes		P	
EC 28.06.00	Use gears	I	P	S
B 28.06.01	Define gears	I	P	
B 28.06.02	Identify types of gears, their materials, and their applications	I	P	
B 28.06.03	Identify installation method	I	P	
B 28.06.04	Install gears		P	
B 28.06.05	Maintain gears (e.g., lubrication)		P	
B 28.06.06	Remove gears		P	
B 28.06.07	Identify gear failure modes		P	
B 28.06.08	Identify gear requirements		P	
B 28.06.09	Select gears appropriate to the application		P	
B 28.06.10	Calculate gear requirements		P	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
EC 28.07.00	Use belts and pulleys	I	P	MS
B 28.07.01	Define belts and pulleys	I	P	
B 28.07.02	Identify types of belts and pulleys and their applications	I	P	
B 28.07.03	Identify installation method	I	P	
B 28.07.04	Install belts and pulleys		P	
B 28.07.05	Maintain belts and pulleys		P	
B 28.07.06	Remove belts and pulleys		P	
B 28.07.07	Identify belt and pulley failure modes		P	
B 28.07.08	Identify belt and pulley requirements		P	
B 28.07.09	Select belt and pulley appropriate to the application		P	
B 28.07.10	Calculate belt and pulley requirements		P	
EC 28.08.00	Use cams and levers	I	P	MS
B 28.08.01	Define cams and levers	I	P	
B 28.08.02	Identify types of cams and levers and their applications	I	P	
B 28.08.03	Identify installation method		P	
B 28.08.04	Install cams and levers		P	
B 28.08.05	Maintain cams and levers		P	
B 28.08.06	Remove cams and levers		P	
B 28.08.07	Identify failure modes		P	

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130

112

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 28.09.00	Use sprockets and chains	I	P	MS
B 28.09.01	Define sprockets and chains	I	P	
B 28.09.02	Identify types of sprockets and chains and their applications	I	P	
B 28.09.03	Identify installation method	I	P	
B 28.09.04	Install sprockets and chains		P	
B 28.09.05	Maintain sprockets and chains		P	
B 28.09.06	Remove sprockets and chains		P	
B 28.09.07	Identify sprocket and chain failure modes		P	
B 28.09.08	Identify sprocket and chain requirements		P	
B 28.09.09	Select sprocket and chain appropriate to the application		P	
B 28.09.10	Calculate sprocket and chain requirements		P	
EC 28.10.00	Use clutches and brakes	I	P	MS
B 28.10.01	Define clutches and brakes	I	P	
B 28.10.02	Identify types of clutches and brakes and their applications	I	P	
B 28.10.03	Identify installation method	I	P	
B 28.10.04	Install clutches and brakes		P	
B 28.10.05	Maintain clutches and brakes		P	
B 28.10.06	Remove clutches and brakes		P	
B 28.10.07	Identify clutch and brake failure modes		P	
B 28.10.08	Identify clutch and brake requirements		P	
B 28.10.09	Select clutches and brakes appropriate to the application		P	
B 28.10.10	Calculate clutch and brake requirements		P	

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131

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
EC 28.11.00	Install drive components	I	P	
B 28.11.01	Define drive component	I	P	
B 28.11.02	Identify types of drive components and their applications	I	P	
B 28.11.03	Identify installation method	I	P	
B 28.11.04	Explain drive component installation		P	
B 28.11.05	Explain drive component maintenance		P	
B 28.11.06	Explain drive component removal		P	
B 28.11.07	Identify drive component failure modes		P	
B 28.11.08	Identify drive component requirements		P	
B 28.11.09	Select drive component appropriate to the application		P	
B 28.11.10	Calculate drive component requirements		P	
B 28.11.11	Identify types of couplings and their applications		P	
B 28.11.12	Install solid coupling		P	
B 28.11.13	Install jaw coupling		P	
B 28.11.14	Install molded rubber coupling		P	
B 28.11.15	Install chain type coupling		P	
B 28.11.16	Install a clutch		P	
B 28.11.17	Install brakes		P	
B 28.11.18	Align bearings, bushing, and cams		P	
B 28.11.19	Install V-belts and adjust tensions		P	
B 28.11.20	Install a V-belt and manually adjustable sheaves		P	
B 28.11.21	Adjust a V-belt and manually adjustable sheaves		P	
B 28.11.22	Install a V-belt with spring loaded adjustable sheaves		P	
B 28.11.23	Explain the purposes and advantages of a chain drive system		P	
B 28.11.24	Explain the function of speed reducers		P	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
B 28.11.25	Explain the function of gears and variable speed reducers		P	
B 28.11.26	Install shafts		P	
B 28.11.27	Align shafts		P	
B 28.11.28	Mount drive sprockets and chains		P	
B 28.11.29	Mount sheaves and pulleys		P	
B 28.11.30	Mount gears on open gear drives		P	
B 28.11.31	Align gears on open gear drives		P	
B 28.11.32	Install a mechanical clutch system		P	
B 28.11.33	Install adjustable speed drives		P	
B 28.11.34	Troubleshoot adjustable speed drives		P	
B 28.11.35	Explain the operation of fluid couplings		P	
B 28.11.36	Install fluid couplings		P	
B 28.11.37	Install torque converters		P	
B 28.11.38	Perform preventive maintenance on drive components		P	
B 28.11.39	Inspect completed work		P	
B 28.11.40	Describe types of fit and tolerances		P	
B 28.11.41	Explain importance of balance		P	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
EC 28.12.00	Describe the operation of mechanisms, linkages and levers	I	P	MS
B 28.12.01	Describe class one, two, three, and compound levers	I	P	
B 28.12.02	Describe the principles and operation of rocker arm and bell crank linkages and combined mechanisms	I	P	
B 28.12.03	Describe the principles and operation of four-bar mechanisms (crank, rocker, and double rocker)		P	
B 28.12.04	Describe the principles and operation of drag link and intermediate mechanisms		P	
B 28.12.05	Describe the principles and operation of four-bar variations		P	
B 28.12.06	Describe the principles and operation of cam mechanisms	I	P	
B 28.12.07	Describe the principles and operation of pivoted follower mechanisms		P	
B 28.12.08	Describe the principles and operation of toggler, quick return, and ratchet mechanisms		P	
B 28.12.09	Describe the principles and operation of geneva mechanisms		P	

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134

116

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
EC 28.13.00	Apply knowledge of lubricants	I	P	MS
B 28.13.01	Explain the function of lubricants	I	P	
B 28.13.02	Explain the properties of oil lubricants and factors determining the selection of lubricants	I	P	
B 28.13.03	Identify types and functions of lubricant additives	I	P	
B 28.13.04	Describe types of circulating oils and their purposes		P	
B 28.13.05	Describe lubricating systems, including the charts and methods used		P	
B 28.13.06	Demonstrate proper grease applications		P	
B 28.13.07	Demonstrate proper lubricant storage and handling		P	
B 28.13.08	Lubricate a piece of industrial equipment		P	
B 28.13.09	Identify specified lubricant or equivalent		P	
B 28.13.10	Explain lubricant recovery and disposal		P	
B 28.13.11	Explain use of oil analysis reports		P	

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U 29.00.00	Fundamentals of Machine Anatomy			
EC 29.01.00	Interpret specification for a machine	I	P	CMS
B 29.01.01	Identify power source	I	P	
B 29.01.02	Identify power transmission	I	P	
B 29.01.03	Identify hydraulic/pneumatic actuators		P	
B 29.01.04	Identify materials		P	
B 29.01.05	Identify fits/tolerances		P	
B 29.01.06	Identify geometric dimension and tolerancing (GD&T) symbols		P	
B 29.01.07	Identify safety factors		P	
B 29.01.08	Demonstrate knowledge of print reading		P	

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136

118

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 29.02.00	Build a machine to specifications	I	P	MS
B 29.02.01	Install hydraulic and pneumatic actuators	I	P	
B 29.02.02	Troubleshoot hydraulic and pneumatic actuators		P	
B 29.02.03	Install motors	I	P	
B 29.02.04	Troubleshoot motors		P	
B 29.02.05	Install sensors	I	P	
B 29.02.06	Troubleshoot sensors		P	
B 29.02.07	Install PLCs		P	
B 29.02.08	Troubleshoot PLCs		P	
B 29.02.09	Install industrial controls		P	
B 29.02.10	Troubleshoot industrial controls		P	
B 29.02.11	Install power distribution systems		P	
B 29.02.12	Troubleshoot power distribution systems		P	
B 29.02.13	Install brakes and clutches		P	
B 29.02.14	Troubleshoot brakes and clutches		P	
B 29.02.15	Install lubrication systems		P	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
U 30.00.00	Electromechanical Technology for IM			
EC 30.01.00	Interpret electromechanical drawings	I	P	CMS
B 30.01.01	Identify types of drawings and their applications		P	
B 30.01.02	Explain the use of auxiliary views and sectional views	I	P	
B 30.01.03	Describe dimensioning practices and techniques on drawings		P	
B 30.01.04	Interpret mechanical/electronic production and assembly drawings	P		
EC 30.02.00	Describe the operation of electronic sensors and transducers	I	P	CMS
B 30.02.01	Explain temperature transducers operation	I	P	
B 30.02.02	Explain liquid and fluid flow transducers operation		P	
B 30.02.03	Explain stress and strain pressure transducers operation		P	
B 30.02.04	Explain magnetic transducers operation		P	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
RC 30.03.00	Demonstrate knowledge of transducers (sensors) and instrumentation	I	I	CMS
B 30.03.01	Describe thermocouple characteristics	I		
B 30.03.02	Describe characteristics associated with transducers and instrumentation		I	
B 30.03.03	Describe the principles and operations of various types of transducers (e.g., thermal, shock/vibration, acceleration, positional, pressure, flow, optical, gas, and humidity)		I	
B 30.03.04	Demonstrate the use of various transducers (e.g., thermal, shock/vibration, acceleration, positional, pressure, flow, optical, gas, and humidity)		I	
B 30.03.05	Differentiate among thermocouple types		I	
B 30.03.06	Interpret specifications of temperature sensors (e.g., thermocouples, thermistors, resistance temperature devices)		I	
B 30.03.07	Interpret specifications of flow sensors (e.g., orifice flow meter, turbine meter, mass flow meters)		I	
B 30.03.08	Explain use of photo electric sensors	I	R	
B 30.03.09	Demonstrate the use of control and measurement circuits		I	

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RC 30.04.00	Demonstrate knowledge of motors and motor controls		I	CMS
B 30.04.01	Describe operation of common AC motors		I	
B 30.04.02	Define advantages and disadvantages of common DC motors		I	
B 30.04.03	Explain how load is connected to 3-phase wye configured AC generator		I	
B 30.04.04	Identify wye connected and delta connected 3-phase motors		I	
B 30.04.05	Explain revolving fields in AC motors		I	
B 30.04.06	Explain power factor effect on motors		I	
B 30.04.07	Demonstrate two and three wire control concepts		I	
B 30.04.08	Explain motor starter/overloads		I	
B 30.04.09	Describe operation of variable frequency AC drives		I	
B 30.04.10	Explain motor nameplate data		I	
RC 30.05.00	Demonstrate knowledge of power distribution systems	I	I	CMS
B 30.05.01	Describe power distribution systems	I	R	
B 30.05.02	Describe poly-phase distribution systems		I	
B 30.05.03	Describe single-phase distribution systems	I	R	
B 30.05.04	Describe DC distribution systems		I	
B 30.05.05	Describe delta distribution systems		I	
B 30.05.06	Describe wye distribution systems		I	
B 30.05.07	Describe medium-voltage distribution systems (less than 600v)		I	

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140

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
RC 30.06.00	Demonstrate knowledge of power distribution equipment		I	CMS
B 30.06.01	Describe power transformers		I	
B 30.06.02	Describe transformer name plate data		I	
B 30.06.03	Describe power capacitors		I	
B 30.06.04	Describe power oil switches and cutouts		I	
B 30.06.05	Describe application of NEMA or IEC controls		I	
B 30.06.06	Describe different types of enclosures for controls		I	
B 30.06.07	Describe current transformers		I	
B 30.06.08	Describe current transformer safety procedures		I	
B 30.06.09	Describe potential transformers		I	
B 30.06.10	Describe medium-voltage circuit breakers and fuses		I	

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U 31.00.00	Hydraulics and Pneumatics			
EC 31.01.00	Describe fluid flow concepts	I	P	CMS
B 31.01.01	Explain Pascal's Law	I	P	
B 31.01.02	Explain Boyle's Law	I	P	
B 31.01.03	Explain Bernoulli's Principle	I	P	
B 31.01.04	Describe flow velocity	I	P	
B 31.01.05	Explain how heat and pressure relate to power and transmission	I	P	
B 31.01.06	Describe physical and chemical properties of a fluid	I	P	
B 31.01.07	Describe fluids in motion in closed conductors	I	P	
B 31.01.08	Describe continuity of mass flow	I	P	
B 31.01.09	Identify types of fluids	I	P	
B 31.01.10	Identify properties of fluids	I	P	
B 31.01.11	Identify English and metric units of measurement for pressure, density, and viscosity	I	P	
EC 31.02.00	Describe energy considerations	P	R	CS
B 31.02.01	Differentiate work and power	P	R	
B 31.02.02	Differentiate potential and kinetic energy	P	R	
B 31.02.03	Explain energy conservation concept	P	R	
B 31.02.04	Explain hydraulic horsepower	P	R	
B 31.02.05	Explain work of compression in compressible fluids	P	R	

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142

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
EC 31.03.00	Describe system losses	I	P	CS
B 31.03.01	Differentiate turbulent and laminar flow	I	P	
B 31.03.02	Explain friction factor	I	P	
B 31.03.03	Explain pressure losses	I	P	
B 31.03.04	Identify potential system losses (e.g., leaks, wear, component sizing, heat, dirt)	I	P	
EC 31.04.00	Describe hydrostatics	P	R	CS
B 31.04.01	Explain pressure, density, and viscosity	P	R	
B 31.04.02	Explain buoyancy	P	R	
B 31.04.03	Explain equilibrium	P	R	
EC 31.05.00	Calculate energy	I	P	MS
B 31.05.01	Apply Pascal's Law	I	P	
B 31.05.02	Apply Bernoulli's Principle	I	P	
B 31.05.03	Apply Boyle's Law	I	P	
B 31.05.04	Calculate work and power	I	P	
B 31.05.05	Calculate potential and kinetic energy	I	P	
B 31.05.06	Calculate hydraulic horsepower	I	P	
B 31.05.07	Calculate flow velocity and pressure	I	P	
B 31.05.08	Calculate pressure losses	I	P	
B 31.05.09	Calculate laminar flow		P	
B 31.05.10	Calculate pump capacity	I	P	
B 31.05.11	Calculate system requirements	I	P	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 31.06.00	Design basic hydraulic/pneumatic system	I	P	S
B 31.06.01	Use common symbols	I	P	
B 31.06.02	Create circuit diagrams (i.e., schematics)		P	
B 31.06.03	Diagram closed-loop hydraulic system		P	
B 31.06.04	Diagram an air supply system		P	
EC 31.07.00	Describe component operation	I	P	CS
B 31.07.01	Identify functions and operation of hydraulic components		I	P
B 31.07.02	Identify functions and operation of pneumatic components		P	
B 31.07.03	Explain application(s) of different materials (e.g., plastic, copper)		P	
B 31.07.04	Identify and interpret pressure ratings		P	
EC 31.08.00	Interpret hydraulic and pneumatic schematics	I	P	S
B 31.08.01	Identify common symbols	I	P	
B 31.08.02	Sketch circuit diagrams (i.e., schematics)		P	
B 31.08.03	Interpret circuit diagrams (i.e., schematics)	I	P	
B 31.08.04	Sketch circuit analysis		P	
B 31.08.05	Analyze circuit		P	
B 31.08.06	Diagram an air supply system		P	
EC 31.09.00	Troubleshoot hydraulic (and pneumatic) circuits	I	P	S
B 31.09.01	Analyze hydraulic circuits	I	P	
B 31.09.02	Troubleshoot hydraulic circuits		P	
B 31.09.03	Analyze pneumatic circuits		P	
B 31.09.04	Troubleshoot pneumatic circuits		P	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
RC 31.10.00	Explain pump operation		I	CS
B 31.10.01	Identify types and operating features of pumps		I	
B 31.10.02	Identify pump capacity and system requirements		I	
B 31.10.03	Explain packing and seal requirements		I	
B 31.10.04	Explain operating principles of pumps (e.g., centrifugal, propeller and turbine rotary, metering)		I	
RC 31.11.00	Explain piping and accessories for low pressure fluid power systems		I	CS
B 31.11.01	Identify components of a piping system		I	
B 31.11.02	Explain features of both metallic and non-metallic piping systems		I	
B 31.11.03	Explain types of valves and their operation and maintenance		I	
B 31.11.04	Explain use of strainers, filters, and traps in piping systems		I	
EC 31.12.00	Describe reciprocating and rotary air compressors	I	P	CS
B 31.12.01	Explain relationship of force, weight, mass, and density in pneumatic system	I	P	
B 31.12.02	Explain operation of reciprocating compressors		P	
B 31.12.03	Explain operation of rotary compressors		P	
B 31.12.04	Explain primary and secondary air treatment (e.g., air dryers, lubricating systems)		P	
B 31.12.05	Explain operation of compressor valves, cylinders, and motors		P	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 31.13.00	Maintain hydraulic system components	I	P	CMS
B 31.13.01	Install a contaminant removal system		P	
B 31.13.02	Maintain a contaminant removal system		P	
B 31.13.03	Explain operation and use of heat exchanges	I	P	
B 31.13.04	Identify reservoir requirements	I	P	
B 31.13.05	Compute hose requirements		P	
B 31.13.06	Install hydraulic lines		P	
B 31.13.07	Select control valves		P	
B 31.13.08	Install control valves		P	
EC 31.14.00	Troubleshoot hydraulic systems	I	P	CS
B 31.14.01	Interpret hydraulic schematic	I	P	
B 31.14.02	Identify causes of failure modes	I	P	
B 31.14.03	Explain hydraulic system troubleshooting techniques		P	
B 31.14.04	Replace hydraulic valves		P	
B 31.14.05	Replace hydraulic cylinders		P	
B 31.14.06	Replace hydraulic pumps and motors		P	
B 31.14.07	Install hydraulic components		P	

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146

128

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
EC 31.15.00	Troubleshoot pneumatic systems	I	P	CS
B 31.15.01	Interpret pneumatic schematic		P	
B 31.15.02	Diagram an air supply system	I	P	
B 31.15.03	Install pneumatic system components	I	P	
B 31.15.04	Explain pneumatic system troubleshooting procedures		P	
B 31.15.05	Troubleshoot air compressors		P	
B 31.15.06	Troubleshoot pneumatic control valves		P	
B 31.15.07	Troubleshoot air motors		P	
B 31.15.08	Troubleshoot air dryers		P	

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147

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
U 32.00.00	Computerized Numerical Control (CNC)			
RC 32.01.00	Demonstrate knowledge of CNC	I	P	C
B 32.01.01	Define computerized numerical control (CNC)	I	P	
B 32.01.02	Describe closed loop, open loop, and adaptive controls	I	P	
B 32.01.03	Identify data input mediums	I	P	
B 32.01.04	Explain the purpose of the post-processor	I	P	
B 32.01.05	Define canned cycles	I	P	
B 32.01.06	Identify computer memory types	I	P	
B 32.01.07	Differentiate hardware and software	I	P	
B 32.01.08	Differentiate among CNC, machining centers, and robots	I	P	
B 32.01.09	List advantages/disadvantages of CNC machining centers	I	P	
B 32.01.10	Explain direct numerical control (DNC)	I	P	
B 32.01.11	Apply basic G-code programming (i.e., milling, turning, simple geometrics)	I	P	
B 32.01.12	Determine if CNC is economically beneficial to manufacture a specific part	I	P	
B 32.01.13	Explain the role of CNC in the evolution of manufacturing	I	P	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
RC 32.02.00	Set up CNC machining center (This competency does not apply to CT)	P	R	
B 32.02.01	Load program from MDI and off-line programming station	P	R	
B 32.02.02	Prepare work-holding device	P	R	
B 32.02.03	Mount work-holding device	P	R	
B 32.02.04	Secure workpiece	P	R	
B 32.02.05	Set up reference and clearance points	P	R	
B 32.02.06	Set up tooling/automated tool changer	P	R	
B 32.02.07	Select proper lubrication/coolant	P	R	
EC 32.03.00	Load machine (This competency does not apply to CT)	I	P	M
B 32.03.01	Load program from MDI and off-line programming station	I	P	
B 32.03.02	Prepare work-holding device	I	P	
B 32.03.03	Mount work-holding device	I	P	
B 32.03.04	Secure workpiece	I	P	
B 32.03.05	Set up reference and clearance points	I	P	
B 32.03.06	Set up tooling/automated tool changer	I	P	
B 32.03.07	Select proper lubrication/coolant	I	P	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 32.04.00	Operate CNC machining center (This competency does not apply to CT)	I	P	M
B 32.04.01	Load raw material	I	P	
B 32.04.02	Start cycle	I	P	
B 32.04.03	Monitor work in-process	I	P	
B 32.04.04	Edit CNC programs	I	P	
B 32.04.05	Demonstrate ability to halt running program	I	P	
B 32.04.06	Apply proper safety procedures	I	P	
B 32.04.07	Demonstrate proper cleaning of CNC machine	I	P	
B 32.04.08	Apply tool offsets	I	P	
B 32.04.09	Inspect part	I	P	
RC 32.05.00	Operate CNC turning center (This competency does not apply to CT)	P	R	
B 32.05.01	Load raw material	P	R	
B 32.05.02	Start cycle	P	R	
B 32.05.03	Monitor work in-process	P	R	
B 32.05.04	Edit CNC programs	P	R	
B 32.05.05	Demonstrate ability to halt running program	P	R	
B 32.05.06	Apply proper safety procedures	P	R	
B 32.05.07	Demonstrate proper cleaning of CNC machine	P	R	
B 32.05.08	Apply tool offsets	P	R	

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150

132

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
RC 32.06.00	Manufacture workpiece (e.g., rectangular, round, angular) (This competency does not apply to CT)	P	R	
B 32.06.01	Dry-run machine	P	R	
B 32.06.02	Run part	P	R	
B 32.06.03	Inspect part	P	R	
EC 32.07.00	Apply CNC operations (This competency does not apply to CT)	I	P	C
B 32.07.01	Identify parts of the machine	I	P	
B 32.07.02	Apply basic programming skills to a turning and a milling operation	I	P	
B 32.07.03	Select proper work holders	I	P	
B 32.07.04	Select proper cutting tools	I	P	
B 32.07.05	Use CAD/CAM for part program development	I	P	
B 32.07.06	Set proper cutting tool offsets	I	P	
EC 32.08.00	Prepare CNC program (This competency does not apply to CT)	I	P	
B 32.08.01	Write a program manually in word address format	I	P	
B 32.08.02	Write a program off line	I	P	
B 32.08.03	Write a program manually in conversational program	I	P	
B 32.08.04	Generate a program using CAD/CAM package	I	P	
B 32.08.05	Program machine using manual data input (MDI) process	I	P	

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151

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
EC 32.09.00	Program CNC operations (This competency does not apply to CT)	I	P	M
B 32.09.01	Apply ANSI drawing standards	I	P	
B 32.09.02	Apply process planning from drawing to finished product	I	P	
B 32.09.03	Analyze workpiece	I	P	
B 32.09.04	Perform basic trigonometric computations	P	R	
B 32.09.05	Perform cutter compensation computations	I	P	
B 32.09.06	Contrast differences in computer-assisted programming	I	P	
B 32.09.07	Set chip load, feed rates and surface feet per minute limitations	I	P	
B 32.09.08	Turn intersection points into segments (i.e., defined in terms of points, lines, and circles)	I	P	
B 32.09.09	Debug program	I	P	

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152

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
U 33.00.00	Precision Machining			
EC 33.01.00	Perform prerequisite machining skills	P	R	CM
B 33.01.01	Demonstrate maintenance of immediate work area, machinery, tools and gages	P	R	
B 33.01.02	Demonstrate proficiency in interpreting prints/drawings	P	R	
B 33.01.03	Demonstrate proficiency in planning work sequence/set up	P	R	
B 33.01.04	Follow safety rules and regulations for each machine	P	R	
B 33.01.05	Use personal protective equipment for each machine	P	R	
EC 33.02.00	Analyze machine shop jobs	P	R	CM
B 33.02.01	Identify sequence of work on specified project(s)	P	R	
B 33.02.02	Identify tolerances and surface finishes on specified project(s)	P	R	
B 33.02.03	Identify variables that affect efficiency (e.g., speeds, feeds)	P	R	
B 33.02.04	Use Machinery Handbook	P	R	
B 33.02.05	Identify causes of workpiece defects	P	R	
EC 33.03.00	Perform bench operations	P	R	MS
B 33.03.01	Use measuring instruments and hand tools	P	R	
B 33.03.02	Deburr workpiece	P	R	
B 33.03.03	Lay out workpiece	P	R	
B 33.03.04	Drill hole	P	R	
B 33.03.05	Hand tap hole	P	R	
B 33.03.06	Cut threads with die	P	R	
B 33.03.07	Apply basic metallurgy knowledge	P	R	

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153

135

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 33.04.00	Achieve machine shop job standards	P	R	CM
B 33.04.01	Write machine shop job procedure	P	R	
B 33.04.02	Complete machine shop job status report(s)	P	R	
B 33.04.03	Analyze machine shop job evaluation data	P	R	
EC 33.05.00	Operate metal cutting saw	P	R	CMS
B 33.05.01	Identify types and uses	P	R	
B 33.05.02	Transfer dimensions from blueprint	P	R	
B 33.05.03	Clean metal cutting saw	P	R	
B 33.05.04	Lubricate metal cutting saw	P	R	
B 33.05.05	Install guides	P	R	
B 33.05.06	Adjust guides	P	R	
B 33.05.07	Select proper blades	P	R	
B 33.05.08	Install saw blade	P	R	
B 33.05.09	Select speeds and feeds	P	R	
B 33.05.10	Cut metal	P	R	
B 33.05.11	Deburr workpiece	P	R	
B 33.05.12	Apply basic metallurgy knowledge	P	R	
B 33.05.13	Identify proper cutting fluids	P	R	

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154

136

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
EC 33.06.00	Operate drill press	P	R	CMS
B 33.06.01	Clean drill press	P	R	
B 33.06.02	Lubricate drill press	P	R	
B 33.06.03	Identify proper cutting fluid	P	R	
B 33.06.04	Mount part	P	R	
B 33.06.05	Select proper bit, speed and feed	P	R	
B 33.06.06	Demonstrate proper bit sharpening techniques	P	R	
B 33.06.07	Drill part	P	R	
B 33.06.08	Countersink	P	R	
B 33.06.09	Tap hole	P	R	
B 33.06.10	Apply basic metallurgy knowledge	P	R	
EC 33.07.00	Operate tool and cutter grinding machine	I	P	CMS
B 33.07.01	Identify parts of machine	I	P	
B 33.07.02	Identify proper cutting fluids	I	P	
B 33.07.03	Identify causes of workpiece defects	I	P	
B 33.07.04	Select proper wheels and work holding devices (e.g., superabrasives)		P	
B 33.07.05	Perform truing operations		P	
B 33.07.06	Perform dressing operations		P	
B 33.07.07	Perform forming operations		P	
B 33.07.08	Select proper speeds and feeds		P	
B 33.07.09	Apply basic metallurgy knowledge		P	

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155

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 33.08.00	Operate pedestal grinder	I	P	CMS
B 33.08.01	Clean pedestal grinder	I	P	
B 33.08.02	Lubricate pedestal grinder	I	P	
B 33.08.03	Identify proper wheel	I	P	
B 33.08.04	Identify proper coolant	I	P	
B 33.08.05	Check wheel for defects	I	P	
B 33.08.06	Mount wheel	I	P	
B 33.08.07	Position guard and rest	I	P	
B 33.08.08	Dress wheel	I	P	
B 33.08.09	Sharpen drill bit	I	P	
B 33.08.10	Apply basic metallurgy knowledge	I	P	
EC 33.09.00	Operate surface grinder	I	P	MS
B 33.09.01	Clean surface grinder	I	P	
B 33.09.02	Lubricate surface grinder	I	P	
B 33.09.03	Identify proper cutting fluid	I	P	
B 33.09.04	Select proper wheel	I	P	
B 33.09.05	Select proper speeds and feeds	I	P	
B 33.09.06	Check wheel for defects	I	P	
B 33.09.07	Install wheel	I	P	
B 33.09.08	Position guard	I	P	
B 33.09.09	Dress wheel	I	P	
B 33.09.10	Identify proper holding/fixtures methods	I	P	
B 33.09.11	Load workpiece	I	P	
B 33.09.12	Set surface grinder	I	P	
B 33.09.13	Apply basic metallurgy knowledge	I	P	

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EC 33.10.00	Operate Lathe	I	P	CMS
B 33.10.01	Clean lathe	I	P	
B 33.10.02	Lubricate lathe	I	P	
B 33.10.03	Deburr	I	P	
B 33.10.04	Demonstrate use of a 4-jaw chuck	I	P	
B 33.10.05	Identify proper cutting fluid	I	P	
B 33.10.06	Identify proper tools and holders	I	P	
B 33.10.07	Sharpen tools properly	I	P	
B 33.10.08	Mount workpiece	I	P	
B 33.10.09	Use dial indicator	I	P	
B 33.10.10	Position guards	I	P	
B 33.10.11	Select feed(s) and speed(s)	I	P	
B 33.10.12	Face workpiece	I	P	
B 33.10.13	Turn shaft	I	P	
B 33.10.14	Turn taper	I	P	
B 33.10.15	Knurl workpiece	I	P	
B 33.10.16	Cut off workpiece	I	P	
B 33.10.17	Center drill hole	I	P	
B 33.10.18	Cut threads (inside and outside)	I	P	
B 33.10.19	Turn inside bore	I	P	
B 33.10.20	Demonstrate use of steady rest	I	P	
B 33.10.21	Demonstrate use of centers	I	P	
B 33.10.22	Apply basic metallurgy knowledge	I	P	

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157

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 33.11.00	Operate milling machine	I	P	CMS
B 33.11.01	Clean milling machine	I	P	
B 33.11.02	Lubricate milling machine	I	P	
B 33.11.03	Identify proper cutting fluid	I	P	
B 33.11.04	Select proper tool	I	P	
B 33.11.05	Select proper surface feet per minute	I	P	
B 33.11.06	Calculate proper feeds and speeds	I	P	
B 33.11.07	Type of cut (e.g., climb, std.)	I	P	
B 33.11.08	Mount workpiece	I	P	
B 33.11.09	Mount tool	I	P	
B 33.11.10	Mill surface	I	P	
B 33.11.11	Mill keyway	I	P	
B 33.11.12	Drill workpiece	I	P	
B 33.11.13	Bore with milling machine	I	P	
B 33.11.14	Mill angle	I	P	
B 33.11.15	Apply basic metallurgy knowledge	I	P	
EC 33.12.00	Select materials	I	P	CMS
B 33.12.01	Interpret color codes, numbering systems, and classification systems of materials (i.e., ANSI, SAE)	I	P	
B 33.12.02	Identify metals using spark test	I	P	
B 33.12.03	Identify metals using variety of tests	I	P	
B 33.12.04	Identify materials	I	P	
B 33.12.05	Apply basic metallurgy knowledge	I	P	

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158

140

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 33.13.00	Perform heat treatment and testing of metals	I	P	MS
B 33.13.01	Harden metals to job specifications	I	P	
B 33.13.02	Temper metals to job specifications	I	P	
B 33.13.03	Anneal metals to job specifications	I	P	
B 33.13.04	Normalize metals to job specifications	I	P	
B 33.13.05	Test hardness of metals	I	P	
B 33.13.06	Explain non-destructive testing methods		P	
B 33.13.07	Perform destructive testing		P	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
EC 33.14.00	Explain nontraditional machining processes	I	P	CM
B 33.14.01	Describe principles of chemical etching	I	P	
B 33.14.02	List applications of chemical etching	I	P	
B 33.14.03	List advantages/disadvantages of chemical etching	I	P	
B 33.14.04	Describe principles of photochemical etching	I	P	
B 33.14.05	List applications of photochemical etching	I	P	
B 33.14.06	List advantages/disadvantages of photochemical etching	I	P	
B 33.14.07	Describe electrical-discharge machining (EDM)	I	P	
B 33.14.08	List applications of EDM	I	P	
B 33.14.09	Differentiate between EDM and wire EDM	I	P	
B 33.14.10	List applications for wire EDM	I	P	
B 33.14.11	Describe principles of electrochemical machining		P	
B 33.14.12	List applications of electrochemical machining		P	
B 33.14.13	List advantages/disadvantages of electrochemical machining		P	
B 33.14.14	Describe principles of water jet cutting		P	
B 33.14.15	List applications of water jet cutting		P	
B 33.14.16	Describe principles of torch cutting	I	P	
B 33.14.17	List applications of torch cutting	I	P	
B 33.14.18	Describe principles of laser cutting		P	
B 33.14.19	List applications of laser cutting		P	
B 33.14.20	List advantages/disadvantages of laser cutting		P	
B 33.14.21	Describe shot peen		P	
B 33.14.22	Describe media finish		P	
B 33.14.23	Describe glass bead		P	
B 33.14.24	Describe principles of laser welding		P	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>I2</i>	<i>AD</i>	<i>AC</i>
EC 33.15.00	Perform precision layouts	I	P	CMS
B 33.15.01	Identify appropriate tools for measuring	I	P	
B 33.15.02	Describe precision, accuracy, tolerance, reliability, and discrimination	I	P	
B 33.15.03	Distinguishing between precision and semiprecision measuring	I	P	
B 33.15.04	Define standard stock dimensions and tolerances	I	P	
B 33.15.05	Demonstrate knowledge of different units of measure (metric, standard, inches, etc.)	I	P	
B 33.15.06	Describe common measurement errors and correction procedures	I	P	
B 33.15.07	Calibrate measuring machines and devices	I	P	
B 33.15.08	Demonstrate care of measuring instruments	I	P	
B 33.15.09	Demonstrate use of rule	I	P	
B 33.15.10	Demonstrate use of tape	I	P	
B 33.15.11	Demonstrate use of combination square	I	P	
B 33.15.12	Demonstrate use of calipers	I	P	
B 33.15.13	Demonstrate use of micrometers (inside and out)	I	P	
B 33.15.14	Demonstrate use of dial indicators	I	P	
B 33.15.15	Demonstrate use of sine bar	I	P	
B 33.15.16	Demonstrate use of gauges (e.g., dial bore, dial snaps)	I	P	
B 33.15.17	Demonstrate use of surface plate	I	P	
B 33.15.18	Demonstrate use of protractor head	I	P	
B 33.15.19	Explain use of profilometer to determine surface finish	I	P	
B 33.15.20	Demonstrate use of thermometer (for ambient conditions)	I	P	
B 33.15.21	Demonstrate use of dividers	I	P	
B 33.15.22	Demonstrate basic use of gauge blocks	I	P	

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161

143

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B 33.15.23	Demonstrate use of threading specs	I	P	
B 33.15.24	Explain use of optical comparitor	I	P	
B 33.15.25	Explain use of digital instruments	I	P	
B 33.15.26	Explain use of electronic gauging equipment	I	P	
B 33.15.27	Explain use of data acquisition equipment	I	P	
B 33.15.28	Explain operation of manual coordinate measuring machine (CMM)	I	P	
B 33.15.29	Explain use and application of laser alignment/measurement	I	P	
RC 33.16.00	Perform basic physical layouts	I	P	
B 33.16.01	Use inside diameter (ID), outside diameter (OD), and hermaphrodite calipers	I	P	
B 33.16.02	Lay out with combination square	I	P	
B 33.16.03	Lay out with scribe, divider and trammel	I	P	
B 33.16.04	Use surface plate	I	P	
B 33.16.05	Use surface gage	I	P	
B 33.16.06	Use layout fluid	I	P	
B 33.16.07	Use V-blocks	I	P	
B 33.16.08	Use clamps	I	P	
B 33.16.09	Use angle plate	I	P	
B 33.16.10	Use parallels	I	P	
B 33.16.11	Use punches	I	P	
B 33.16.12	Use transfer method tools	I	P	
B 33.16.13	Use layout hammer	I	P	
B 33.16.14	Use machinist's square	I	P	
B 33.16.15	Use universal bevel protractor	I	P	
B 33.16.16	Use machinist's scale	I	P	

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162

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U 34.00.00	Metal Stamping Dies			
RC 34.01.00	Describe different types of dies	I		C
B 34.01.01	Describe crimping die	I		
B 34.01.02	Describe parts assembly die	I		
B 34.01.03	Describe CAM bending die	I		
B 34.01.04	Describe blanking die	I		
B 34.01.05	Describe pierce die	I		
B 34.01.06	Describe forming die	I		
B 34.01.07	Describe draw die	I		
B 34.01.08	Describe progressive die	I		
RC 34.02.00	Describe fixtures	I		C
B 34.02.01	Describe crimping fixture	I		
B 34.02.02	Describe locating fixture	I		
B 34.02.03	Describe press fitting fixture	I		
B 34.02.04	Describe riveting fixture	I		
B 34.02.05	Describe welding fixture	I		
RC 34.03.00	Troubleshoot design errors	I		CMS
B 34.03.01	Isolate cause of die component breakage	I		
B 34.03.02	Isolate cause of failure of parts to be removed from die	I		
B 34.03.03	Isolate cause of incorrect punch clearance	I		
B 34.03.04	Isolate cause of incorrect die clearance	I		
B 34.03.05	Isolate cause of misfitting die components	I		

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RC 34.04.00	Explain die processing		I	CM
B 34.04.01	Describe preplanning activities		I	
B 34.04.02	Describe die layout		I	
B 34.04.03	Identify die operations (e.g., number, purpose and sequence of die operations)		I	
B 34.04.04	Describe feasibility study development		I	
B 34.04.05	Describe sequence of operations from die construction		I	

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164

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U 35.00.00 Press Technology

RC 35.01.00	Explain press operation	I	P
B 35.01.01	Identify types of presses	I	P
B 35.01.02	Describe functions of presses		P
B 35.01.03	Identify capacity of presses		P
B 35.01.04	Describe shuttheight		P
B 35.01.05	Identify operator safety devices		P

RC 35.02.00	Demonstrate knowledge of press accessories		I
B 35.02.01	Describe function of monitors, proximity switches and die protection		I
B 35.02.02	Describe function of loaders		I
B 35.02.03	Describe function of roller levelers		I
B 35.02.04	Describe function of decoilers		I
B 35.02.05	Describe function of feeders		I
B 35.02.06	Describe function of transfer mechanisms		I
B 35.02.07	Describe function of lubricators and coolants		I
B 35.02.08	Describe processing of coil steel		I
B 35.02.09	Describe use of quick die change		I
B 35.02.10	Describe press set-up		I

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U 36.00.00	Sheet Metal Fabrication			
RC 36.01.00	Demonstrate knowledge of sheet metal fabrication	I	I	CMS
B 36.01.01	Describe sheet metal fabricated products	I	R	
B 36.01.02	Describe press working process	I	R	
B 36.01.03	Describe process(es) of straightening metal	I	R	
B 36.01.04	Describe metal finishing and coating	I	R	
B 36.01.05	Explain bend allowances	I	R	
B 36.01.06	Identify materials used for sheet metal fabrication (e.g., hot roll, cold roll, aluminum, stainless)	I	R	
B 36.01.07	Explain process of layout		I	
B 36.01.08	Explain process of fastening		I	
B 36.01.09	Explain process of punch and die clearance and alignment		I	
RC 36.02.00	Describe types of metal fabrication manufacturing	I	R	CM
B 36.02.01	Describe shear	I	R	
B 36.02.02	Describe press brake	I	R	
B 36.02.03	Describe cut-to-length lines	I	R	
B 36.02.04	Describe roll forming	I	R	
B 36.02.05	Describe CNC turret presses	I	R	
B 36.02.06	Describe FMS cells	I	R	

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U 37.00.00 Welding Basics

EC 37.01.00	Explain basic gas welding, brazing and cutting	I	P	MS
B 37.01.01	Follow safety guidelines	I	P	
B 37.01.02	Differentiate welding and brazing	I	P	
B 37.01.03	Identify gas welding and cutting equipment and accessories	I	P	
B 37.01.04	Use personal protective equipment required for welding and cutting	I	P	
B 37.01.05	Explain capillary attraction as it applies to metal	I	P	
B 37.01.06	Demonstrate proper lighting, adjusting, and shutting down of gas torch	I	P	
B 37.01.07	Explain basic metallurgy technology	I	P	

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EC 37.02.00	Perform basic arc welding/cutting (i.e., stick)	I	P	
B 37.02.01	Identify arc welding equipment and accessories	I	P	
B 37.02.02	Explain process of resistance welding	I	P	
B 37.02.03	Explain process of projection welding	I	P	
B 37.02.04	Explain process of flash-butt welding	I	P	
B 37.02.05	Explain process of laser welding	I	P	
B 37.02.06	Explain process of friction welding	I	P	
B 37.02.07	Explain process of spot welding	I	P	
B 37.02.08	Explain process of shielded metal-arc welding (SMAW)	I	P	
B 37.02.09	Explain process of gas metal-arc welding (GMAW)	I	P	
B 37.02.10	Explain process of gas tungsten-arc welding (GTAW)	I	P	
B 37.02.11	Explain process of plasma-arc cutting	I	P	
B 37.02.12	Explain process of carbon arc gouging and cutting	I	P	
B 37.02.13	Explain process of welding plastics	I	P	
B 37.02.14	Explain welding rod alloys	I	P	
B 37.02.15	Read welding rods	I	P	
B 37.02.16	Explain mild steel welding rod	I	P	
B 37.02.17	Explain low hydrogen welding electrode	I	P	
B 37.02.18	Explain rationale for preheating and post-heating metal	I	P	
B 37.02.19	Explain (GMAW) welding in flat, horizontal, vertical positions	I	P	
B 37.02.20	Explain (GTAW) welding on mild steel, stainless steel, and aluminum	I	P	
B 37.02.21	Explain process of build up and hard facing	I	P	
B 37.02.22	Troubleshoot fusion of materials	I	P	
B 37.02.23	Weld stainless steel using (SMAW) process	I	P	

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B 37.02.24	Weld cast iron	I	P	
B 37.02.25	Weld aluminum	I	P	
B 37.02.26	Apply basic metallurgy technology	I	P	

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U 38.00.00	Production Methods and Costs			
RC 38.01.00	Apply design processes to determine a recommended solution to a methods problem		P	
B 38.01.01	Form the problem (Phase One)		P	
B 38.01.02	Analyze the problem (Phase Two)		P	
B 38.01.03	Determine alternative solutions (Phase Three)		P	
B 38.01.04	Evaluate the alternative solutions (Phase Four)		P	
B 38.01.05	Determine specifications for the chosen solution (Phase Five)		P	
B 38.01.06	Explain how to sell and install the chosen solution (Phase Five)		P	
RC 38.02.00	Apply diagrammatic aids used in methods work		P	
B 38.02.01	Apply a flow diagram		P	
B 38.02.02	Apply a flow chart		P	
B 38.02.03	Apply a precedent diagram and multiple activities chart		P	
B 38.02.04	Apply a Gantt chart		P	
B 38.02.05	Apply an operation processes chart		P	
B 38.02.06	Apply a trip frequency chart		P	
B 38.02.07	Apply a learning curve		P	
RC 38.03.00	Apply the principles of motion economy to the solution of industrial problems		I	
B 38.03.01	Determine I.E. standards and M.O.S.T.		I	
B 38.03.02	Formalize methods for economic technology problem solving		P	

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170

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RC 38.04.00	Determine operating costs of each alternative		P	
B 38.04.01	Apply standard costs to manufacturing alternatives		P	
B 38.04.02	Design for Manufacturing (DFM)		P	

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U 39.00.00	Engineering Mechanics			
RC 39.01.00	Determine all support reactions and forces acting on all internal two-force members of a statically loaded coplanar system in equilibrium, using the equation of friction as required			P
B 39.01.01	Find the resultant of a parallel force system in equilibrium	I		P
B 39.01.02	Find the resultant of concurrent force systems in equilibrium			P
B 39.01.03	Use the concept of distributed force in solution of problems			P
B 39.01.04	Determine stresses in trusses			P
B 39.01.05	Find the resultant of noncurrent force systems in equilibrium			P
RC 39.02.00	Determine all support reactions and forces acting on all internal two-force members of a statically loaded noncoplanar system in equilibrium, using the equation of friction as required			P
B 39.02.01	Draw free body diagrams			P
B 39.02.02	Use equations of equilibrium			P
B 39.02.03	Use graphical solutions			P
RC 39.03.00	Solve force system problems utilizing equations of frictions	I		P
B 39.03.01	Use coefficient of friction	I		P
B 39.03.02	Use angle of friction			P
B 39.03.03	Use laws of friction	I		P
B 39.03.04	Solve problems involving belt friction			P

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172

154

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RC 39.04.00	Determine analytically the forces acting on all internal members by the application of the method of joints and the method of sections, given a statically loaded truss		P	
B 39.04.01	Determine the forces on all internal members using the method of joints		P	
B 39.04.02	Determine the forces on all internal members using the method of sections		P	
RC 39.05.00	Determine the location of the center of gravity, given all dimensions of any simple and composite geometrical areas		P	
B 39.05.01	Calculate centroids and centers of gravity		P	
B 39.05.02	Calculate centroids of simple geometric areas		P	
B 39.05.03	Calculate centroids of composite areas		P	
RC 39.06.00	Determine the moment of inertia of any composite geometrical area	I	P	
B 39.06.01	Calculate moments of inertia of simple areas	I	P	
B 39.06.02	Calculate moments of inertia of composite areas		P	
B 39.06.03	Determine radius of gyration		P	

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173

155

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U 40.00.00	Advanced Engineering Mechanics			
RC 40.01.00	Apply equations of kinematics and kinetics to solve for unknown forces and motions, given a rectilinear system having unbalanced forces, applying the equations of friction as required			P
B 40.01.01	Solve equations of rectilinear motion			P
B 40.01.02	Apply inertia force, dynamic equilibrium, friction and other forces in the solution of problems of systems of motion			P
B 40.01.03	Apply valid checking to all problem solutions to verify answers			P
RC 40.02.00	Apply equations of kinematics and kinetics to solve for unknown forces and motions, given a curvilinear system having unbalanced forces, applying the equations of friction as required			P
B 40.02.01	Solve problems using normal acceleration	I		P
B 40.02.02	Solve problems using tangential acceleration			P
B 40.02.03	Solve problems involving projectile motion			P
B 40.02.04	Solve problems involving curvilinear motion in vertical plane			P
B 40.02.05	Apply valid checking to all problem solutions to verify answers			P
RC 40.03.00	Apply equations of kinematics and kinetics of rotation	I		P
B 40.03.01	Solve problems of angular displacement, velocity and acceleration	I		P
B 40.03.02	Solve problems of inertial moment	I		P
B 40.03.03	Solve problems of dynamic equilibrium of rotating bodies			P
B 40.03.04	Solve problems of center of percussion			P

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174

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RC 40.04.00	Determine unknown forces and motions in a body experiencing plane motion			P
B 40.04.01	Find instantaneous center			P
B 40.04.02	Solve problems involving the kinematics of plane motion			P
B 40.04.03	Solve problems involving the kinetics of plane motion			P
B 40.04.04	Apply valid checking to all problem solutions to verify answers			P
RC 40.05.00	Apply the concepts of work, energy, and power in the solution of problems and engineering mechanics	I		P
B 40.05.01	Solve problems using the concept of potential and kinetic energy	I		P
B 40.05.02	Solve problems using the concept of conservation of energy	I		P
B 40.05.03	Determine the amount of power required and the efficiency of a rotating body	I		P
B 40.05.04	Apply valid checking to all problem solutions to verify answers			P

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157

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U 41.00.00 Computer Programming

RC 41.01.00	Demonstrate fundamental programming skills in a language such as FORTRAN, PASCAL, VISUAL BASIC, or C		I	
B 41.01.01	Create a program file in an IDE or appropriate editor		I	
B 41.01.02	Compile, link, and run a program		I	
B 41.01.03	Use a debugger or IDE diagnostics to troubleshoot programs		I	
B 41.01.04	Use program statements to read data from the keyboard and report program output on the user or graphics screens		I	
B 41.01.05	Use both free and formatted IO		I	
B 41.01.06	Use conditional operations to perform branching		I	
B 41.01.07	Use definite and indefinite looping operations to perform repetitive tasks		I	
B 41.01.08	Use mathematical operations to solve simple engineering problems		I	
B 41.01.09	Use subscripted variables to store and process individual data values		I	
B 41.01.10	Use both procedure and function type subprograms		I	
B 41.01.11	Pass parameters to and from subprograms		I	
B 41.01.12	Write clear but terse program documentation		I	
B 41.01.13	Add requested new features to programs provided		I	
B 41.01.14	Participate in a group effort in which each team member helps to design and implement a large program		I	
B 41.01.15	Use computer graphics and audio capabilities if available		I	
B 41.01.16	Make extensive use of on-line help capabilities to search for and learn to use new program features		I	
B 41.01.17	Anticipate and trap mistakes by the program user		I	

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
B 41.01.18	Write programs to solve engineering problems involving extensive calculations or data processing or machine control		I	

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U 42.00.00	Computer-Based Descriptive Geometry			
RC 42.01.00	Demonstrate knowledge of computer-based descriptive geometry as a graphical tool to solve design problems			P
B 42.01.01	Determine or specify direction by either Bearing or Azimuth			P
B 42.01.02	Find the True Length of a line in any spacial orientation by either the rotation or auxiliary view methods			P
B 42.01.03	Determine the True Angle that a line makes with a principle view, auxiliary view, or any spacial orientation of a plan			P
B 42.01.04	Find the point or end view of any line in space			P
B 42.01.05	Find the shortest distance or shortest line of a given grade between a point and line or between two skew lines			P
B 42.01.06	Find the edge view of a plane in any orientation in space, using either the rotation or auxiliary view methods			P
B 42.01.07	Determine the true angle that a plan makes with the horizontal plane or the true angle between any two planes in space			P
B 42.01.08	Find the true view of any plane in space regardless of its orientation, using either the rotation or the auxiliary view methods			P
B 42.01.09	Find the spacial relationship between points, lines, and plans, including the shortest distance point to plane and true angle between line and plane			P
B 42.01.10	Find the points or line of intersection between line, plane, or curved surfaces and polyhedrons, cylinders, and cones			P
B 42.01.11	Determine the strike, dip, outcrop, and thickness of an ore vein from these borings			P
B 42.01.12	Find the line of intersection between a plane surface derived from a cut or fill and contours of a topographical map			P

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173

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U 43.00.00 Design of Machines and Machine Elements

RC 43.01.00	Demonstrate a knowledge of the design approach	P
B 43.01.01	Identify the core problem(s) of a design situation	P
B 43.01.02	Use reference sources, engineering handbooks, and design manuals	P
B 43.01.03	Write computer problems to solve design problems	P
RC 43.02.00	Determine stress and deformation on machine elements under axial, torsional and transverse load	P
B 43.02.01	Solve problems involving axial tension, compression, shear, and bearing stresses and strains	P
B 43.02.02	Solve problems involving torsional stresses and strains	P
B 43.02.03	Analyze rotating shafts and their couplings	P
B 43.02.04	Draw shear and moment diagrams for cantilever, overhanging, and simply-supported beams subjected to concentrated, distributed loads and couples	P
B 43.02.05	Analyze and design beams and fabricated structures having simple geometric shapes	P
B 43.02.06	Draw Mohr's circle to establish the principal stresses and maximum shearing stresses	P
B 43.02.07	Analyze and design structural elements subjected to combined normal and shearing stresses	P
B 43.02.08	Determine the deflection of cantilever, overhanging, and simply-supported beams using the moment-area method	P

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RC 43.03.00	Use the machine design process in the design and/or selection of primary machine elements		P	
B 43.03.01	Size and select keys, pins, splines and threaded fasteners		P	
B 43.03.02	Design power screws		P	
B 43.03.03	Design shaft and shaft mountings		P	
B 43.03.04	Design gear systems		P	
B 43.03.05	Select and specify bearings and lubrication system and components		P	
B 43.03.06	Select couplings, clutches and brakes		P	
B 43.03.07	Select chain drives, belt drives and flywheels		P	
B 43.03.08	Select springs		P	
B 43.03.09	Use factor of safety and metal fits and tolerances in the solution of machine design problems		P	

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U 44.00.00	Quality			
RC 44.01.00	Demonstrate knowledge of basic mathematical methods required for quality applications	I	P	
B 44.01.01	Manipulate basic mathematical operations (addition, subtraction, multiplication, division)	P		
B 44.01.02	Manipulate mathematical operations using fractions	P		
B 44.01.03	Manipulate mathematical operations using decimals	P		
B 44.01.04	Manipulate mathematical operations using scientific notation	I	P	
B 44.01.05	Manipulate mathematical operations using percentages	P		
B 44.01.06	Manipulate mathematical operations using metric and English measurement systems	I	P	
B 44.01.07	Manipulate mathematical operations using metric prefixes	I	P	
B 44.01.08	Perform error calculation	I	P	
B 44.01.09	Calculate areas and volumes	P		
B 44.01.10	Solve algebraic equations in one variable	P	R	
B 44.01.11	Graph linear equations	P	R	
B 44.01.12	Construct bar graphs and histograms	I	P	
B 44.01.13	Perform angle measurement	P	R	
B 44.01.14	Interpret summation notation	I	P	

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RC 44.02.00	Demonstrate a knowledge of basic statistical methods for quality control	I	P	
B 44.02.01	Use graphical data presentation techniques	I	P	
B 44.02.02	Use frequency distributions and cumulative frequency distributions	I	P	
B 44.02.03	Calculate summary statistics (mean and standard deviation)	I	P	
B 44.02.04	Apply Tschebychev's Theorem		P	
B 44.02.05	Define probabilities for simple engineering problems	I	P	
B 44.02.06	Calculate probabilities for simple engineering problems	I	P	
B 44.02.07	Apply probability rules (AND, OR, NOT) to problems		P	
B 44.02.08	Perform expectation calculations for business and quality control problems		P	
B 44.02.09	Calculate fundamental probability distributions to quality control problems in SPC and Acceptance Sampling		P	
B 44.02.10	Apply fundamental probability distributions to quality control problems in SPC and Acceptance Sampling		P	
B 44.02.11	Use approximation methods for calculation of probabilities and interpretation of quality control problems		P	
B 44.02.12	Explain the conditions required for use of the Central Limit Theorem		P	
B 44.02.13	Identify the conditions required for use of the Central Limit Theorem		P	
B 44.02.14	Construct large sample confidence intervals for population means		P	
B 44.02.15	Perform hypothesis tests in the context of SPC and Acceptance Sampling Problems		P	
B 44.02.16	Interpret Type 1 and Type 2 errors and their impact on decision making		P	
B 44.02.17	Use operating characteristic curves to compare sampling plans		P	

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182

164

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<i>Code / Number</i>	<i>Unit/Competency/Builder</i>	<i>12</i>	<i>AD</i>	<i>AC</i>
RC 44.03.00	Demonstrate a knowledge of statistical process control		P	
B 44.03.01	Select rational subgroups for sampling applications		P	
B 44.03.02	Evaluate run rules to interpret SPC charts		P	
B 44.03.03	Use the Western Electric rules to determine the state of a process		P	
B 44.03.04	Describe both appropriate and inappropriate control activities, including managerial tampering		P	
B 44.03.05	Recognize the risks of computerized SPC implementations		P	
B 44.03.06	Design control charts for attribute data (defects and defectives)		P	
B 44.03.07	Construct control charts for attribute data (defects and defectives)		P	
B 44.03.08	Interpret control charts for attribute data (defects and defectives)		P	
B 44.03.09	Apply attribute charts in administrative, general business, safety, material handling, and other nontraditional SPC applications		P	
B 44.03.10	Design control charts for variables data		P	
B 44.03.11	Construct control charts for variables data		P	
B 44.03.12	Interpret control charts for variables data		P	
B 44.03.13	Demonstrate understanding of the management of sample size, sampling intervals, and parameter selection in a large SPC application		P	
B 44.03.14	Calculate meaningful process capability statistics		P	
B 44.03.15	Interpret meaningful process capability statistics		P	
B 44.03.16	Demonstrate knowledge of non-Shewhart type SPC charts		P	

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RC 44.04.00	Demonstrate knowledge of Acceptance Sampling Methods		P	
B 44.04.01	Operate single and double sampling plans	I	P	
B 44.04.02	Design single and double sampling plans to meet selected risk levels		P	
B 44.04.03	Use OC curves to evaluate and compare the performance of different sampling plans		P	
B 44.04.04	Use ASN curves to evaluate the cost and administrative difficulties of single, double, multiple, and sequential sampling plans		P	
B 44.04.05	Select AQL sampling plans from ANSI/ASQC Z1.4		P	
B 44.04.06	Operate AQL sampling plans from ANSI/ASQC Z1.4		P	
B 44.04.07	Use the switching rules applying to normal, tightened, and reduced inspection as prescribed by ANSI/ASQC Z1.4		P	
B 44.04.08	Select single and double rectifying inspection sampling plans using Dodge-Romig for specified AOQL and LTPD levels		P	
B 44.04.09	Operate single and double rectifying inspection sampling plans using Dodge-Romig for specified AOQL and LTPD levels		P	
B 44.04.10	Design a single sampling plan for variables data to meet specified risk levels		P	
B 44.04.11	Operate a single sampling plan for variables data to meet specified risk levels		P	
B 44.04.12	Select sampling plans for variable data using plans selected from ANSI/ASQC Z1.9		P	
B 44.04.13	Operate sampling plans for variable data using plans selected from ANSI/ASQC Z1.9		P	

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RC 44.05.00	Demonstrate knowledge of metrological instruments	I	I	
B 44.05.01	Use steel rules for English and metric measurements	I	P	
B 44.05.02	Use vernier and dial calipers and other vernier instruments	I	P	
B 44.05.03	Use micrometers and vernier micrometers	I	P	
B 44.05.04	Use gage blocks and dial indicators for comparison measurement	I	P	
B 44.05.05	Use the optical comparator to make direct and translation measurements	I	P	
B 44.05.06	Use the rule of 10 to select appropriate instruments for tasks	I	P	
B 44.05.07	Interpret metrological language, including accuracy, precision, repeatability, and reproducibility	I	P	
B 44.05.08	Design gage error short and long studies to determine suitability of measurement instruments for tasks		P	
B 44.05.09	Execute gage error short and long studies to determine suitability of measurement instruments for tasks		P	
B 44.05.10	Interpret gage error short and long studies to determine suitability of measurement instruments for tasks		P	
B 44.05.11	Interpret the total measured variation in a process in terms of the actual process (part) variation and measurement system variation	I	P	
B 44.05.12	Use the bevel protractor, sine bar, and optical comparator to make angle measurements	I	P	
B 44.05.13	Use gage pins or bearings to make interior angle measurements		I	
B 44.05.14	Use thread pitch gages	I	P	
B 44.05.15	Use the three wire and pitch diameter micrometer to measure thread pitch diameter		I	
B 44.05.16	Use thread plug gages and ring gages to check threads	I	P	
B 44.05.17	Use thread plug gages to measure thread hole depth	I	P	

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B 44.05.18	Demonstrate exposure to a variety of other dimensional measurement devices, e.g., optical flats, profilometers, etc.		I	
B 44.05.19	Demonstrate exposure to non-dimensional measurement devices, e.g., pressure gages, temperature gages, electrical measurement devices, etc.		I	
RC 44.06.00	Apply calibration procedures and standards	I	I	
B 44.06.01	Explain different types of calibration errors (zero-set, linearity, periodicity, topical, and illegitimate)	I	P	
B 44.06.02	Explain the hierarchy of calibration and traceability	I	P	
B 44.06.03	Design short calibration checks of calipers, micrometers, and related instruments using gage blocks as standards		P	
B 44.06.04	Execute short calibration checks of calipers, micrometers, and related instruments using gage blocks as standards		P	
B 44.06.05	Explain the calibration requirements of ISO9000 and QS9000		I	
B 44.06.06	Demonstrate knowledge of ISO10012 Calibration Systems Requirements		I	
B 44.06.07	Explain the calibration requirements of ISO10012 - QA Requirements for Measuring Equipment		I	

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RC 44.07.00	Use traditional quality tools and methods	I	I	
B 44.07.01	Use histograms	P		
B 44.07.02	Use scatterplots	I	P	
B 44.07.03	Use Cause and Effect (Fishbone or Ishikawa) Diagrams	I	P	
B 44.07.04	Use Pareto charts and the Pareto Principle	I	P	
B 44.07.05	Use flow charts	I	P	
B 44.07.06	Use check sheets	I	P	
B 44.07.07	Use run (SPC) charts	I	P	
B 44.07.08	Use Design of Experiments		I	
B 44.07.09	Use Quality Functional Deployment (QFD)		I	
B 44.07.10	Use Quality Cost Analysis	I	R	
B 44.07.11	Use Just In Time (JIT)	I	R	
B 44.07.12	Use benchmarking		I	
B 44.07.13	Use process reengineering		I	
RC 44.08.00	Apply Quality Cost Philosophy	I	P	
B 44.08.01	Identify the four types of Quality Costs (Internal and External Failure, Prevention, and Appraisal)	I	P	
B 44.08.02	Classify cost items into the appropriate categories	I	P	
B 44.08.03	Distinguish when SPC is a Prevention, Appraisal, or Failure Cost		P	
B 44.08.04	Use quality cost models to identify optimum business operating defect rates		P	
B 44.08.05	Interpret process centering and variation as evidenced in SPC charts in the context of Taguchi's Loss Function		P	
B 44.08.06	Use quality cost analysis to identify improvement opportunities		P	

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RC 44.09.00	Demonstrate knowledge of corporate quality issues	I	I	
B 44.09.01	Define corporate quality in terms of product features, product freedom from deficiencies	I	P	
B 44.09.02	Define corporate quality policy: components and interpretation	I	P	
B 44.09.03	Evaluate quality culture	I	P	
B 44.09.04	Identify internal and external customers	I	P	
B 44.09.05	Describe characteristics for leadership for quality improvement	I	P	
B 44.09.06	Explain importance of top management commitment to quality	I	P	
B 44.09.07	Plan for quality control and improvement	I	P	
B 44.09.08	Identify employee training and development needs	I	P	
B 44.09.09	Identify employee motivation methods	I	P	
B 44.09.10	Design employee performance evaluations			P
B 44.09.11	Analyze employee performance evaluations			P
B 44.09.12	Select team members for quality improvement teams	I	P	
B 44.09.13	Identify service quality requirements	I	P	
B 44.09.14	Identify legal responsibilities	I	P	
B 44.09.15	Identify quality data systems and data analysis			I
B 44.09.16	Evaluate product reliability and safety	I	P	
B 44.09.17	Evaluate customer satisfaction	I	P	
B 44.09.18	Perform quality auditing (internal and third party audits)	I	P	
B 44.09.19	Describe certification systems (ISO9000, QS9000, Baldrige)	I	R	

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183

170

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U 45.00.00	Production Planning and Control			
RC 45.01.00	Demonstrate a knowledge of the materials management function within a manufacturing environment		I	
B 45.01.01	Calculate an economic order quantity, taking into account the variables of setup charges, inventory carrying costs, annual usage, and quantity discounts		I	
B 45.01.02	Calculate the ECQ for a group of items incurring major and minor setups		I	
B 45.01.03	Apply the ABC classification of inventory to a particular inventory distribution		I	
B 45.01.04	Calculate a production plan based on usage and inventory build-up or depletion		I	
B 45.01.05	Calculate a forecast using the technique of first-order exponential smoothing		I	
B 45.01.06	Calculate the weighing factor to be used when converting from a running average basis exponential smoothing		I	
B 45.01.07	Prepare a Materials Requirements Plan (MRP) using a time-phased explosion of a production schedule		I	
B 45.01.08	Calculate the amount of reserve stock required by means of a statistical analysis of demand during lead time and the service level desired		I	
B 45.01.09	Construct a Gantt chart for scheduling work-in-process with a minimum lead time		I	
B 45.01.10	Describe the steps in a purchase cycle		I	

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189

171

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